

## MANAGEMENT VIEW

"GROWTH IN RESEARCH OPPORTUNITY" is being recognized by the establishment of EEL's research activity as a major division of the Institute, EEL Pres. Hupp pointed out last month when appointment of a new executive committee for the new division was announced. (See page 30.) Thus, he noted, this area of interest gains status comparable to the sales, engineering and other divisions of EEL.

GROWTH IN FACILITIES (calculated from an EL&P survey of the electric power industry's '61 proposed construction expenditures to be at a rate 8.9-percent faster than in 1960) continues to take shape as one of the most confident measures of a good year ahead. Unavailable for inclusion in EL&P's forecast issue roundup of corporate statements (EL&P, Feb. 1, page 56), these latest figures tell more of the same optimistic story: ConEdison notes that "by far the greater part of our \$305-million investment in '61 must be spent to expand the company's electric system;" P. S. Elect. & Gas. Co. plans \$150-million expenditure for facilities additions; The Southern Co. announces approval of '61 budgets calling for construction expenditures of \$173-million by its system companies; So. California Edison will spend over \$100-million (\$131-million) for the sixth consecutive year; Kansas G. & E. Co. estimates its construction costs for this year at \$25.7-million.

ELECTRIC UTILITY FINANCING, according to the Irving Trust Co. is not expected to change in volume from the \$1.7-billion scheduled by the "large" companies in 1960. (This was under the '59 figure of \$1.9-billion.) V-P John Childs notes that electric and gas utility financing is "lighter by some \$23-million compared with the first quarter a year ago." Scheduled issues are generally well spread out, with \$174.5-million sought by the electric companies in this first quarter.

SEC APPROVAL OF CAPITALIZATION RATIOS where common stock equity exceeds 30-

percent and long-term debt is less than 65-percent in connection with any future financings of the American Electric Power System, in the Commission's recent ruling on \$40-million bank financing of Kentucky Power Co., drew this comment from AEP's Pres. Sporn: "Capitalization ratios within those limits provides enough flexibility to allow us to continue to operate on an economical basis in respect of capital and costs . . . and this will greatly facilitate our future expansion to meet all the growing requirements . . ."

A DEFINITE REGULATORY STATUS, given to Electric Bond & Share Co. "for the first time in 22 years . . . puts Ebasco in a better position to utilize its own shares in exchange for shares or assets of other companies," the company notified stockholders in a letter last month. Freed from the restrictions of the Public Utility Holding Co. Act, Ebasco planned immediately to: (a) register as an investment company; and (b) apply for listing on the N. Y. Stock exchange.

## ECONOMIC CLIMATE

STRENGTH UNDERLIES the economy, with total output of goods and services remaining high, despite declines that have affected a wide range of industries. The biggest dips, however, have been in industries hit by excessive inventory accumulations. This is a distinctly favorable factor in the outlook. Stocks cannot overhang so active a market forever. While it is likely that inventory reductions will continue for a while, the rate of decline will certainly slow soon. Though there is little immediate prospect for a return to accumulation of inventories, in many industries a mere slackening of the rate of decline will give impetus to new production. Only major maladjustment readily visible in the economy is a high rate of unemployment.

GOVERNMENT ACTIONS to spur business activity were taken even before the Kennedy Administration took over the White House. The Federal Reserve eased



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credit. The Eisenhower Administration took some steps to stimulate residential building and highway construction. Placement of military contracts was stepped up. These things, plus continued high consumer spending as a satisfactory rate of economic activity keeps incomes high, should contribute to a perceptible expansion of business in the next few months.

TRANSMISSION AND DISTRIBUTION equipment is expected to have a better year in 1961 than in 1960. At the end of the third quarter of last year, scheduled shipments of T&D equipment were 37-million kva for 1961 and later, of which 63-percent was for this year. An increase is expected in kva of transformers per kw of generating capacity from 5.37 at the end of 1960 to 5.43 at the end of 1961. Shipments in 1960 exceeded \$950-million.

## WASHINGTON INFLUENCE

POWER OUTLOOK under the new Administration calls for a great increase in Federal responsibility. Kennedy task-force recommendations confirm the worst fears of many investor-owned utilities. Some of its suggestions include: progressive evaluation standards for multi-purpose projects; cost-allocation formulae for multi-purpose projects consistent with the principle of regulation by competition; and immediate attention to the economic necessity of inter-regional Federal transmission ties. The Kennedy advisory council believes that A-power "developed and financed by the people, should be made available from Federal nuclear power plants as soon as production costs can be materially reduced." The group urges standards for approving multiple-purpose projects that are significantly less stringent than those applied during the Eisenhower Administration. "Highest priority" is urged for projects already authorized and "earliest possible action" is sought for "authorization of projects that have been often delayed because of unreasonable Bureau of the Budget restrictions." A major power recommendation calls for "coal by wire" from depressed mining

areas of West Virginia and Pennsylvania and the coal and lignite deposits of the West.

CAPITAL BUDGET SYSTEM has again been urged by public power advocates. Oregon Democrats Neuberger, Morse, Green, and Ullman have put in bills to make costs of power projects—and REA loans—capital expenses. This was urged in the 1960 Democratic Platform and endorsed by the Kennedy-Johnson Task Force on Resources. The new system would distinguish between capital costs and operating expenses, particularly with regard to mortgage loans for periods exceeding 10 years and long-range resource and conservation projects.

FINAL BUDGET RECOMMENDATIONS of the Eisenhower Administration called for a single water resources agency to take over the jobs of the Corps of Engineers, Interior Department, and the river basin surveying function of the FPC. (The Kennedy Administration is expected to modify many of the Eisenhower budget proposals.)

FEDERAL FUNDS for atomic power would be \$250-million in fiscal 1962 under the Eisenhower program. Five new reactors would begin operation by the end of calendar 1962, when there will be 10 power reactors operating in public and private utility systems. REA electricity financing was put at another \$145-million. Mr. Eisenhower again suggested putting REA loans on a more business-like basis—through a borrower-owned lender—but Congress is certain to do nothing about this.

WATER RESOURCE FUND recommendations in the Eisenhower budget hit a record high. About \$1.2-billion was asked for the Corps of Engineers and the Bureau of Reclamation, with \$1-billion to be used for construction. Congressional approval of the Frying-pan-Arkansas Project was again requested. Legislation to place financing of the Bureau of Reclamation and power marketing agencies on a revolving fund basis was also sought.

DIXON-YATES DECISION by the Supreme Court means that the U. S. will not have to pay almost \$2-million in damages to the Mississippi Valley Generating Co. Majority opinion in the 6-3 vote held that conflict of interest had invalidated



's contract with the utilities. Dissenting opinion for Justices Harlan, Black, and Stewart, said that possible benefit "at some later time" was sufficient grounds. It noted that in a case like this controlling legal issues are apt to become blurred" to indicate an important public policy. Action by Sen. Kefauver (D., Tenn.) who conducted the Senate investigation, was gratification at the decision and a warning to FPC to watch out for a rate increase by the private utilities in the area.

PRICE-FIXING and bid-rigging in the electrical manufacturing industry should be investigated by Congress, says James Carey, IUE head and spokesman for more than 430,000 union workers in the industry. The guilty and no contest pleas of 29 firms means, says the union chief, that purchasers and taxpayers have been swindled out of "uncounted millions of dollars." IUE also demanded the "removal" of Ralph Cordiner, GE board chairman, from the Commerce Department's Business Advisory Council.

BURNS CREEK, Fryingpan-Arkansas, and comprehensive river basin development as well as more Federal participation in developing power have been specifically endorsed by Interior Secretary Hall. Retaining REA interest rates at their present 2-percent level is favored by Agriculture Secretary Freeman.

ALL-FEDERAL WHEELING SYSTEM for conveying power to preference customers of the Colorado River Storage Project was approved by Interior Secretary Seaton in the closing days of the Eisenhower administration. A proposal by a utility to wheel power was rejected because it could have prevented the project from meeting its payout requirements at the rates approved. The Reclamation Bureau will, however, negotiate with private utilities for interconnections with the federal system. Rates approved by the secretary for Colorado River Storage project power—said to meet payout requirements—are 6-mills per kwh for firm energy; 2.5-mills for non-firm power; and \$15 per kw-year for peaking capacity.

NO FEDERAL CONSIDERATION of the value to utilities of occupancy of land on

the right-of-way of the federal-aid highway system is warranted "for the time being," according to a study made by the Bureau of Public Roads. This is primarily a state question, the study says, adding that though the facts of utility benefits from this "should not be ignored," more study is needed before "formulation of measures for the recoupment of a part of the benefits realized by the utility companies."

NUCLEAR REACTOR ACCIDENT at the National Reactor Testing Station last month prompted the AEC to take this "precautionary measure:" Operators of all reactors licensed by the Commission were asked to provide current information about reactor performance, safety and controls. The AEC sought assurance that "all needed steps are taken during maintenance operations to avoid an inadvertent criticality."

NATIONAL ENERGY POLICY is certain to be studied early by the new Administration—the only question seems to be: what group will make it? EL&P's Ralph Elliott comments (on page 37): "Many observers see a distinct possibility of severe friction between Congress and the White House when it comes to the actual laying down of national policy to govern the development and conservation of energy resources . . . and providing for the administration of such a policy."

## INDUSTRY SIFTINGS

LIVE BETTER ELECTRICALLY—After a year of united industry effort, the industry's sales promotion program gains more momentum month-by-month. (At the NAHB convention the end of January, the LBE display listed over 4,000 builders of electrically heated Gold Medallion Homes . . . "who bucked last year's 10-percent nationwide slowdown in new home starts and ran 30-percent ahead of '59.") But as R. L. Albaugh of the Indiana & Mich. Elect. Co. warned the LBE Women's Conference in Chicago: "A tendency toward a slowdown in residential growth pattern . . . and rather high saturation of appliances and kwh use make it increasingly difficult to maintain historical kwh growth rates—(which) means new markets such as elec-



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tric home heating." And, next month, at EEI's annual sales conference, one speaker (Minneapolis-Honeywell's Z. A. Marsh) will warn: "The big need is for air-conditioning, not resistance heating. If the electric companies would emphasize it, they'd do their customers a genuine service . . . and also sell more electricity."

HOME BUYING HABITS and motivation—of obvious concern to utility sales people—are better understood after a \$50,000 study for the NAHB, which revealed preliminary findings on Jan. 30 at the Association's convention. Goal of NAHB for its Housing Industrial promotional Operation (to which the survey is providing guidance): An increase of 250,000 new home units a year by 1970.

FROM THE NATION'S CAPITOL: All the words are not political. With accounts of the reorganizing Congress, the inaugural, and the new administration still dominating U. S. news, the unceasing efforts in selling kilowatt-hours along the banks of the Potomac still deserve mentioning. Examples: In mid-month, the Third Biennial Electric Trade Conference and Exposition attracts several thousand representatives of industry to the District; then, later this month, on the program of the 17th annual National Wiring Sales Conference, "Selling Housepower in the Nation's Capitol" will be discussed by Wm. G. Hills, managing director of the Electric Institute of Washington, D. C.

MORE IMAGINATIVE PACKAGING for small appliances helps sell and aids the customer, even as it eases handling and storage, contends Westinghouse. The company's V-P R. J. Sargent told a National Retail Merchants Assoc. convention last month that "our new approach to packaging should build sales and profits for merchandisers and reduce their operating costs." Among packaging ideas Westinghouse has adopted: Package elements which can be used as stands, receptacles, etc.; packages with hand-holes or handles; easy-opening adhesive sealing; better product identification on cartons.

LATEST RATE CUT ORDERS from the Florida Commission affect Florida P. & L. Co., which is to reduce revenue by \$6.2-million to lower the utility's return from 7.61-percent to 6.98-percent (as figured by the Commission on a year-end original cost rate base); and Tampa Elect. Co., which has been told to lower industrial rates five-percent, on grounds that "a disproportionate share of the utility's cost . . . is now imposed on the large-use customers." (The Commission allowed Tampa Elect. a 1-percent increase in residential rates.)

LOWER RATES—WHY?—Reductions of \$400,000 each on two systems, announced last month, drew these comments from executives of the utility companies involved: Wisconsin P. S. Co.'s Pres. H. B. Taylor: "Increased use of electricity plus continuing improvement in operating efficiency have made the reductions possible . . . and under our long-range program our customers will have benefited by reductions totaling about \$1-million in the past year."; Arizona P. S. Co. Treasurer John L. Liecty: "Over a period of time the increased use of electric energy will more than offset the initial revenue loss . . . —the purpose of these new developmental schedules is to provide an incentive for increased use of electric energy . . . and thereby aid in more commercial and industrial growth."

ATOM MISHAP LIABILITY COVERAGE, possibly the first for a major transportation facility in the U. S., was acquired by the Delaware River Port Authority last month. A \$10-million insurance policy covers damage from nuclear energy or radiation contamination to the Benjamin Franklin or Walt Whitman bridges linking Philadelphia and Camden, N. J., or to any one using them. Regulations prepared for guidance of bridge employees note that, since radioactive elements are not carried by truck, there is a "rare possibility of an incident . . ."

POWER STATION IN INDIA, designed for two-stage construction to provide 600,000 kw for needs of the Calcutta industrial metropolis will be engineered by Kuljia Corp. of Philadelphia. First stage completion for the \$100-million project is 1963.



## MECHANIZATION HAS CHANGED ANCHORING TECHNIQUES



### Your Hole-Boring Equipment Lets You Install Chance Screw Anchors Almost Anywhere in 5 to 8 Man-Minutes

Your present boring equipment, regardless of type, can be adapted to power anchor installation simply by using a special Chance wrench that transmits torque from the digger directly to the hub of the anchor helix. Then, your crews are set to install anchors in 5 to 8 man-minutes . . . *from the time the equipment is moved into position until the anchor is ready for the guy.* (By adding a screw anchor adapter, the installation wrench can be attached without removing the auger bit.)

Chance Power Installed Screw Anchors go down fast, uniformly . . . anywhere that you can bore a pole hole with your power hole-digging equipment. Slow, tedious labor is eliminated. So, too, is error caused by human variables. Line construction is speeded, and you realize more on your investment in hole-boring equipment. Since the anchor rod itself is not subjected to torque, it only has to be heavy enough to support the guy load. That's a cost-saving factor, too.

Chance Screw Anchors range in size from 78 to 176 square inches in area. Their sharp cutting helixes of high-strength structural steel are tapered to minimize earth disturbance. Hundreds of installation and pull tests prove that Chance Power Installed Screw Anchors hold with less creep than any other anchors of comparable size. So, isn't it time for you to consider the advantages of mechanization of screw anchor installations?

#### Use Chance Power Installed Screw Anchors and get:

- Lower installation costs per anchor
- Better utilization of expensive equipment
- Greater holding power with less creep
- Consistent results
- Elimination of human variables
- Less physical effort, better employee relations

Contact your Chance Representative. He'll show you how you can apply this new anchoring technique to save time, cut costs, and improve your anchoring.



# A. B. CHANCE COMPANY

CENTRALIA, MISSOURI (A. B. Chance Company of Canada, Ltd., Toronto)





## Financing: What It Asks Of News Handling

Corporate financing and corporate "publicity" often bring together important company interests and objectives—usually without conflict, but now and then involving somewhat ticklish considerations.

Most utility financial officers and public relations men are acutely conscious of SEC requirements (or the Commission's interpretation of the Securities Act of 1933) regarding press releases distributed during pre-filing or pre-effective periods. But, where financing actions are less frequent, PR men are sometimes in doubt about proper publicity procedures while financing moves are on the fire.

Now, another aspect of financing where the impact of corporate publicity can be felt is: the effect on prices of securities. Recently, this area was the subject of a notice (to the presidents of companies listed on the New York Stock Exchange) from Exchange Pres. G. Keith Funston. His advice: Release immediately to the public any and all news which might affect the price of securities.

Mr. Funston's particular target was the "apparently inadvertent" practice, observed in several recent cases, of issuing important corporate news on a "hold-for-release" basis. In his letter he suggested that executives of the companies make certain that "all financial data and other important corporate developments are made on an immediate release basis, so that security holders and the investing general public will have prompt access to announcements made by the company." (Such disclosure procedures, described in the Exchange's company manual, are part of the member companies' agreement with the Exchange.)

The often-times delicate question of "timing" in the release of financial



Hoover Medal, top award of four leading engineering societies, was made to Pres. Eisenhower last month by Detroit Edison's Walker L. Cisler. A past president of one of the societies (ASME), Mr. Cisler was chairman of the Hoover Medal Board of Award.

information is emphasized again in this recent action of the Exchange executive. In this area, perhaps more than in any other, the "right time" for public exposure of significant corporate information is, of course, a strongly desired end.

But, as even the most experienced of business journalists insist, the "best day" or "best time"—as far as publication in the important daily press goes—simply cannot be predicted ahead.

Analyzing the recent Exchange notice and its significance, Donald I. Rogers, business and financial editor of the "New York Herald Tribune," lauded the action for the contribution it makes toward discouraging any attempts to hold back the news. He commented:

"If news is held back, the effect inevitably is that some people get the information before the general public and thus are in a position to benefit by it. There is the distinct possibility that outright fraud could be perpetrated by the withholding of news, though no one at the Exchange has said that such has happened.

"Many things affect the price of a stock. Sometimes even the announcement of a company appointment of a man at the vice-presidential level can be important to the

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## EEI Research Program Outlined, Committee Named

With more than 1000 research projects under way (or recently completed) as part of the development activities of EEI and its member companies . . . and 120 electric companies already voluntarily supporting the Institute's research program, new top-level leadership has been designated to guide a newly established Research Division, EEI announced last month.

The new Research Division Executive Committee of seven leading electric company chief executives is headed by Willis Gale, chairman of Commonwealth Edison Co. . . . chairman. Members are P. A. Flieger, chairman of the board and president, Duquesne Light Co.; R. A. Gibson, president, The Hartford Electric Light Co.; J. K. Horton, president, Southern California Edison Co.; D. C. Luce, president, Public Service Electric and Gas Co.; W. W. Lynch, chairman of the board and president, Texas Power & Light Co.; and W. O. Turner, chairman of the board, Louisiana Power & Light Co.

The new Division will utilize the Institute's Research Projects Committee, formed nine years ago, which recently made recommendations leading to the establishment of the new Research Division.

EEI's Pres. Sherman R. Knap made it clear that in selecting an administrator for research projects, the Institute's expanded activity would involve projects suited to action by the industry as a whole. "There are many research projects which are better undertaken by individual companies—whether manufacturers or utilities—and there are others better suited to joint action by small groups of companies," he said.

At the present time, the Institute is engaged in 23 research projects

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## Uses Mathematical Models to Help Test "Rightness of Decisions" in Marketing

The Cleveland Electric Illuminating Company has become the first utility in the nation to adopt a new training and development technique for marketing personnel which uses mathematical formulations to help test the rightness of decisions, the utility company reports.

Some 36 Illuminating Company sales department managers, their supervisors and several specialists took part in the first six-session program conducted between January 6 and February 10. Developed by Remington Rand Univac, the marketing management program is based on a set of simulated conditions, and their local office aided in the planning, organizing and execution of the exercise.

"We hope this simulation technique will hone to an even finer edge the decision-making skills of our sales managers and their aides. Also, we expect it to contribute to the development of these key people," states Karl H. Rudolph, vice president—marketing, under whose auspices the exercise was put into play.

Here's how the program is conducted:

The participants are divided into groups of six, each group representing a separate company. At the start, the groups are given like sets of conditions . . . the type of product they are to market . . . geographical boundaries of their sales area . . .

budget . . . the price to be charged for the product.

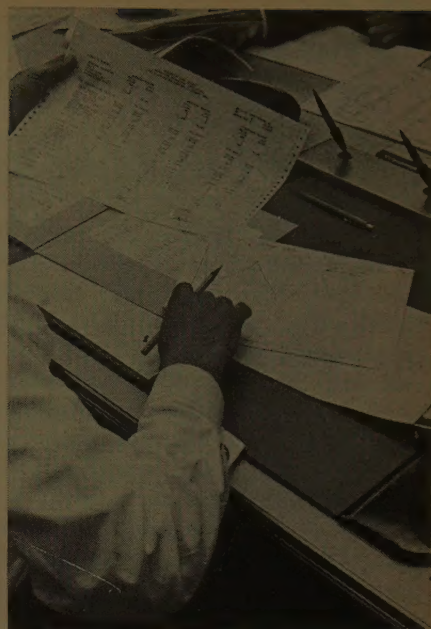
Then, each company is on its own. Objectives are established, officers elected and the company "executives" begin designing and implementing their sales program.

As major decisions are made by the individual companies, they are logged on special forms and passed along to the Remington Rand technicians supervising the exercise. Some of the major decision areas involve pricing, advertising, sales personnel administration, inventory management and market research.

A specially programmed Univac at Case Institute of Technology receives the coded "decisions" and returns a report indicating how the individual companies are doing, what their prospects for success are at that particular time, and how logical are its officers in solving problems which range from hiring and firing to pricing and advertising.

This technique of management development using mathematical models is comparatively new in the business world. However, variations of it have long been used by the military for officer training purposes. In the services, these exercises are referred to as war games, providing logistic experience without loss of life.

The armed forces have found that these games are particularly valuable when it is impossible to partici-

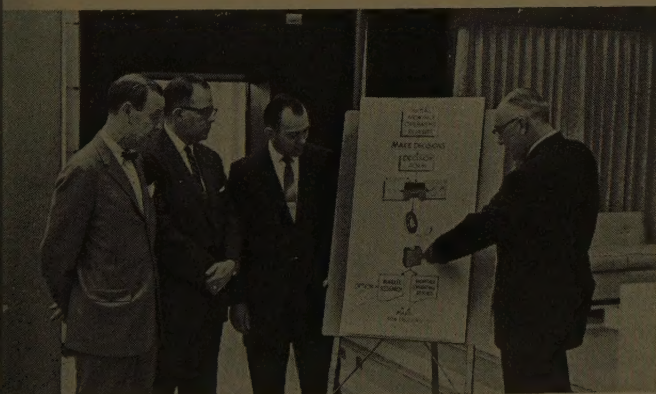


Illuminating Co. salesman charts progress of his company to determine if they should continue policy of "low margin, high volume." His decision will be run through Remington-Rand Univac and the rightness of the decision judged.

pate in the actual situation and also where it would be very expensive to provide field experience on home bases.

The same reasoning applies to business use of simulated commercial exercises such as operating a company and marketing a particular consumer product, as in The Illuminating Company's case. Here, the participant benefits from the positive values of experience, but if a bad decision is made it is not costly to the company.

According to Remington Rand Univac, this is the first time they have ever conducted such a program exclusively for a marketing or sales division of a utility company.

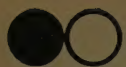


Decision-making procedure, involved in newly applied program for training management personnel at Cleveland Electric Illuminating Co., is explained by Remington-Rand Univac representative, Hank Stelzer, to Illuminating Co. sales department managers (l to r): Will T. Clark, L. DeChant and Frank Kender.



In one of many such "workouts," CEI salesmen participating in the utility's unique training program "buckle down to the rugged job of deciding the company's policies." The exercise is designed to "hone" thinking processes of the men and expose them to other facets of business, such as finance, production, advertising.





## Normalized Taxes Receive Dissenting Support from Chairman of Ohio P.U.C.

The Majority Ruling in this case, which involved a rate increase proceeding of the Cincinnati Gas & Electric Co., had ordered the use of actual taxes when using the provisions of Section 167. Chairman Krueger's dissent from this position is one of the most important contributions to sound regulatory philosophy which has recently been made.

Commissioner Krueger's opinion noted Dr. Eisner's statement that, while on individual items of property there was a deferral of taxes, however on the property as a whole the use of Section 167 resulted in a permanent reduction of taxes. Dr. Eisner's position was that:

"(1) Income and taxes are in fact calculated for a company as a whole and are not identified with specific plant additions of any particular year; and,

(2) Accelerated depreciation will exceed normal straight-line depreciation with a continuing increase in the tax differential so long as the company's depreciable property base does not decline."

On the other hand, Dr. Dorau, appearing for the Company, made it clear:

"(1) That use of a more rapid depreciation rate for tax purposes than for corporate and regulatory purposes creates a liability for the utility when applied either to single units of property or to a composite property for a fixed term or for an indeterminate period;

(2) That the apparent non-maturing character of the liability in a composite, particularly as to a growing property is "... an illusion due to the roll-in of the results of a succession of transaction recurring accruals ..." because old liabilities are being retired and new ones added much like a revolving credit, and if the increment of new liabilities equals the decrements, the balance continues even though the content changes; and,

(3) That "normalization" by the accounting device of an equalization reserve for Federal income taxes is sound and desirable because such accounting method tends to match the total cost of service to the revenues produced by periods of time and purportedly precludes "using up" a good asset in the form of future income tax deductions in behalf of present customers with no assurance of reimbursement from future ratepayers ..."

There is, of course, no question that Dr. Dorau is eminently correct in his analysis.

Commissioner Krueger's opinion noted, among other things, that "should the 'flow-through' treat-

ment of accelerated depreciation continue to be invoked by the majority of this Commission, the extant accounting orders previously issued by the Commission, which authorize tax deferments to be credited to a reserve for deferred taxes, will have to be revoked."

The question that might well be asked here is what would the Ohio Commission do with the reserve which had been set up under its prior orders? Would the balances in the reserve be deducted from the rate base, amortized over the same period of years that it took in setting up these credit balances, or made a part of equity by a direct transfer to surplus? These are some of the questions which face not only the Ohio Commission but the utility industry as a whole if previous Commission findings allowing normalized taxes are going to be reversed.

### Favors Existing Ratepayers

Commissioner Krueger noted that there would be substantial discrimination under the "flow-through" method in favor of existing ratepayers of a utility because future ratepayers would have to face higher charges because of the increased taxes the utility would have to pay.

In dealing with the interests of the Ohio ratepayers, the dissenting opinion noted that: "Another primary reason for my dissent to the majority's adoption of the 'flow-through' treatment of accelerated depreciation is that *this rate-making method will probably result in higher rates to Ohio ratepayers, by virtue of utilities' abandonment of the use of liberalized depreciation rates and reversion to the normal straight-line rate of depreciation* likewise authorized by Section 167. This abandonment of the election of accelerated depreciation by utilities is no idle conjecture or a point of advocacy. It has become a reality in most of the states which have adopted the 'flow-through' rate-making and accounting treatment of accelerated depreciation without some regulatory offering of benefit to the

utilities for the continued election and use thereof.

\* \* \*

"It is my opinion, therefore, that some benefit or benefits accruing from use of accelerated depreciation should be afforded as an incentive to managements of Ohio utilities to continue election of one of the liberalized depreciation options authorized by Section 167. This opinion may be said to simply reflect regulatory judgment or philosophy— suffice to say, however, it is intended to meet regulatorily the economic facts of life in the combined interests of Ohio ratepayers and utilities alike."

Commissioner Krueger noted that the funds resulting from the use of liberalized depreciation constitute in effect an interest-free loan from the Federal Government. The regulatory problem in this instance was the treatment which was accorded to these funds in the setting of rates.

Commissioner Krueger noted that: "This 'interest-free' aspect performs, *advantages* both the utility and its ratepayers by providing lower aggregate costs of capital and resulting lower costs of service."

"Assuming the efficacy of the summary appraisal of the benefits accruing to utilities and ratepayers from use of accelerated depreciation, what degree of incentive might be afforded utilities to continue the election thereof. This determination should be assayed in light of the 'risk' which is purportedly incurred by equity holders from the investment of capital funds in plant and which element of risk is generally recognized, in varying degrees and application, by economists and regulators.

### "Risk"—Matter of Judgment

"The degree of such 'risk' assignable to internally generated funds is a matter of judgment. It could be (1) a full rate of return, (2) a modified rate of return representing the differential between the cost of debt and cost of equity or the differential between the cost of equity and the



l rate of return, etc., and (3) a 'zero' cost of money.

"In my opinion, these deferred dividends should be considered in the termination of the rate of return, has been the Commission's policy heretofore. This treatment affords regulatory flexibility in the consideration of the rate of return with respect to changing economic conditions, to the repeal or modification of extant tax laws, to the economic impact of rates upon ratepayers, and to utilities which may experience difficulty in attracting invested funds to meet capital requirements or sufficient return to meet current costs of capital, including long term debt. Moreover, this method comports with the cost of service concept which includes the incremental requirement for attraction of capital for private enterprise.

\* \* \*

"In the instant case, it is my opinion that a 'zero' rate of return should be assigned to the 'deferred dividend' reserve balance allocated to the applicant's property used and useful for the utility services for which increased rates are herein sought. This judgment determination is reached in light of this utility's capital structure, its existing capital requirements, its programmed plan for modernization and expansion, and other like factors."

Commissioner Krueger's dissent shows clearly that the use of liberalized depreciation with normalized rates would be beneficial to both the ratepayers and to the utility industry.

### **Financial—continued**

investing public. To withhold even such seemingly irrelevant news can sometimes throw an advantage of a few trading hours to those 'in the know,'" observed Mr. Rogers.

The Tribune's financial editor notes that the SEC "has never taken a stand about the subject of corporate news releases. The SEC has, however, clamped down on press conferences or press releases dealing with securities which are in registration or are about to be offered to the public."

The SEC's interpretation of Section 5 of the Securities Act of 1933 has, of course, offered for guidance the industry, underwriters, dealers and counsel in the Commission's

Release No. 3844, issued in Oct., 1957. Included in this advisory release was this acknowledgement regarding the publication of information:

"A basic purpose of the Securities Act of 1933, the Securities Exchange Act of 1934 and the Investment Company Act of 1940 is to require the dissemination of adequate and accurate information concerning issuers and their securities in connection with the offer and sale of securities to the public, and the publication periodically of material business and financial facts, knowledge of which is essential to an informed trading market in such securities.

"There has been an increasing tendency, particularly in the period since World War II, to give publicity through many media concerning corporate affairs which goes beyond the statutory requirements. This practice reflects a commendable and growing recognition on the part of industry and the investment community of the importance of informing security holders and the public generally with respect to important business and financial developments.

"This trend should be encouraged. It is necessary, however, that corporate management, counsel, underwriters, dealers and public relations firms recognize that the Securities Acts impose certain responsibilities and limitations upon persons engaged in the sale of securities and that publicity and public relations activities under certain circumstances may involve violations of the securities laws and cause serious embarrassment to issuers and underwriters in connection with the timing and marketing of an issue of securities. These violations not only pose enforcement and administrative problems for the Commission, they may also give rise to civil liabilities by the seller of securities to the purchaser."

Subsequently, in a talk for an investment bankers' group in March of 1958, SEC Chairman Edward N. Gadsby referred to Release No. 3844 in these words:

"The questions relating to issuers which are most frequently presented concern press releases and speeches by corporate officials during the pre-filing or pre-effective periods. A press release by a corporation an-

nouncing some event in its business would not seem to us to present any particular problem. The announcement of a dividend, the receipt of a contract, the settlement of a strike, the opening of a plant or any similar event of interest to the community in which the business operates have never been looked upon with askance. However, that does not mean that purported news items which tout the companies' securities or which dwell upon the financial aspects of the business ordinarily associated with the sale of securities shall be viewed in the same light."

Still in effect, this SEC stand on corporate announcements should always be in the minds of utility PR people, especially as the tempo of financial activity grows with this ever-bigger growth industry.

### **EET Research—continued**

Recent activities include research on methods of applying heart massage, extra high voltage cable, water pollution, heat storage, galloping conductors, aluminum conductor fittings, electronic accounting machines, high temperature steam generation, and effect of temperatures on properties of metals.

A study is also being made of developments in various power sources which may have potential for the future. These include the fuel cell, thermionic tube, thermoelectric generator, and devices making use of the principle of magneto-hydrodynamics.

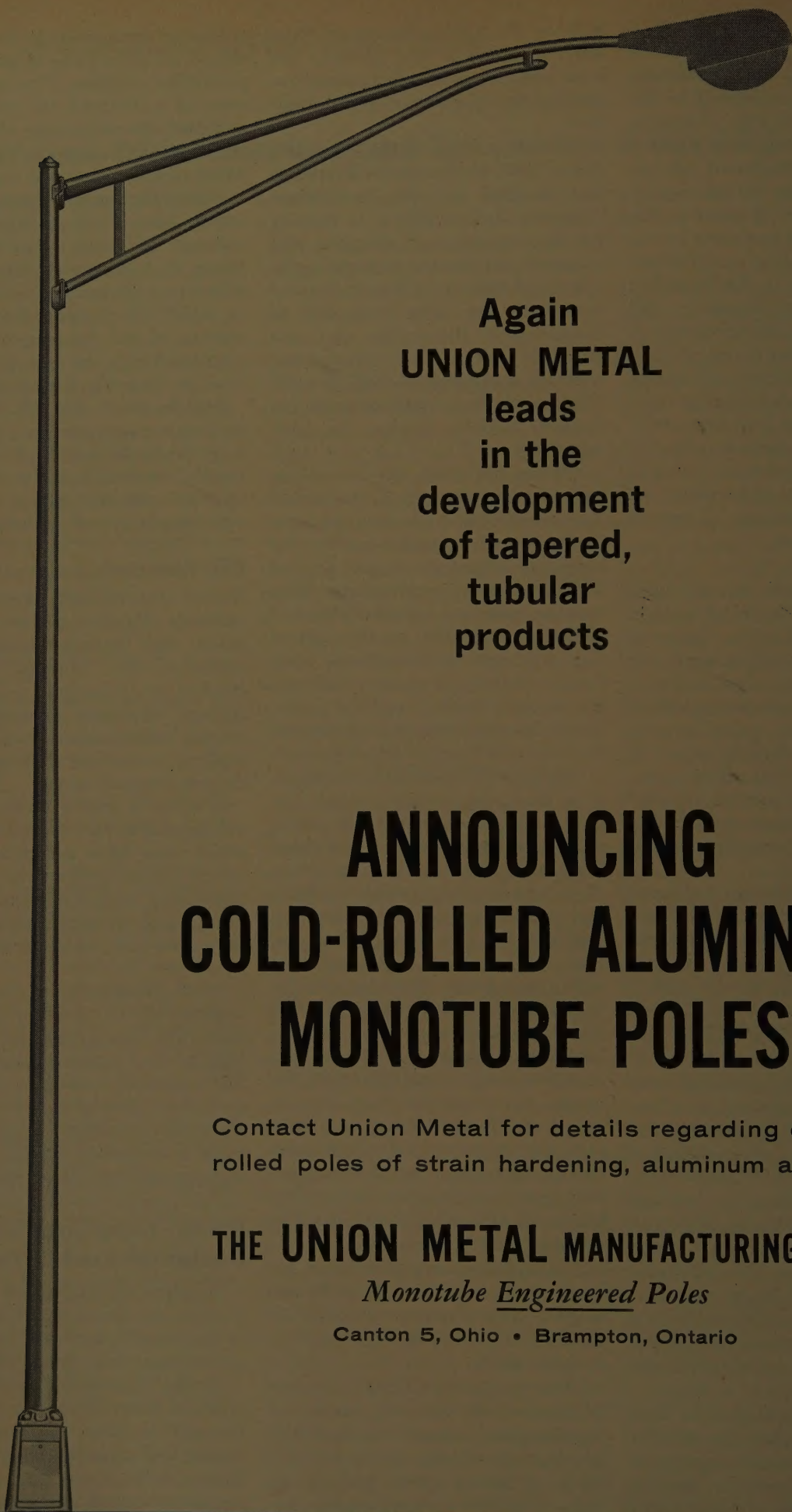
"With leadership of the caliber represented by the new Division's Executive Committee and with the high level of support being given to EET's expanded research activity by companies throughout the country, we expect important progress to be made in a number of fields of industry-wide interest," Mr. Knapp said.

### **Dixon-Yates Case Dissent Doubts Wenzell "Interest"**

Supreme Court Justice John M. Harlan, in his dissenting opinion in the recently decided Dixon-Yates power plant case, declared:

"In the light of the findings of the court of claims, I cannot agree that Wenzell (a New York investment banker and consultant to the Budget Bureau when it was working on the contract) was so interested."





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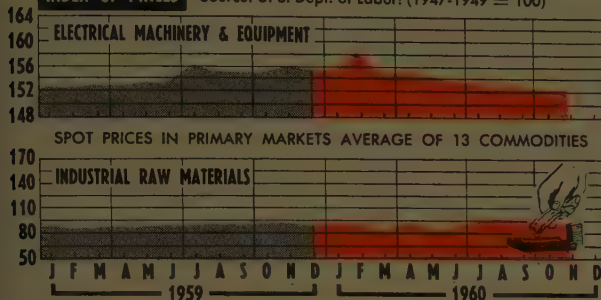
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# MARKETING GUIDEPOSTS

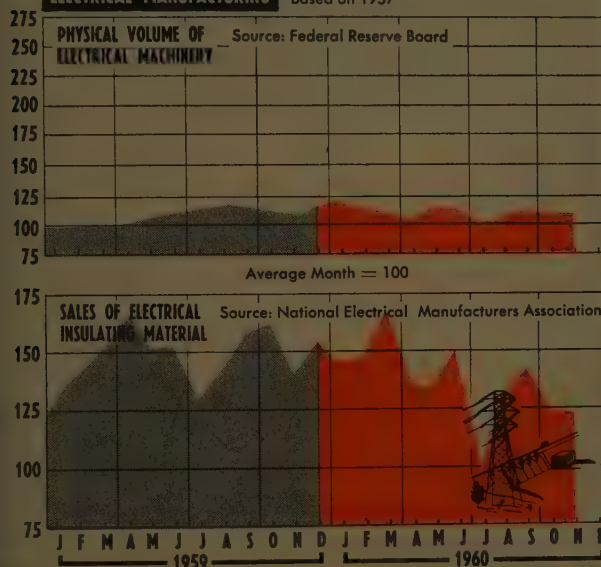
## INDEX OF PRICES

Source: U. S. Dept. of Labor: (1947-1949 = 100)



## ELECTRICAL MANUFACTURING

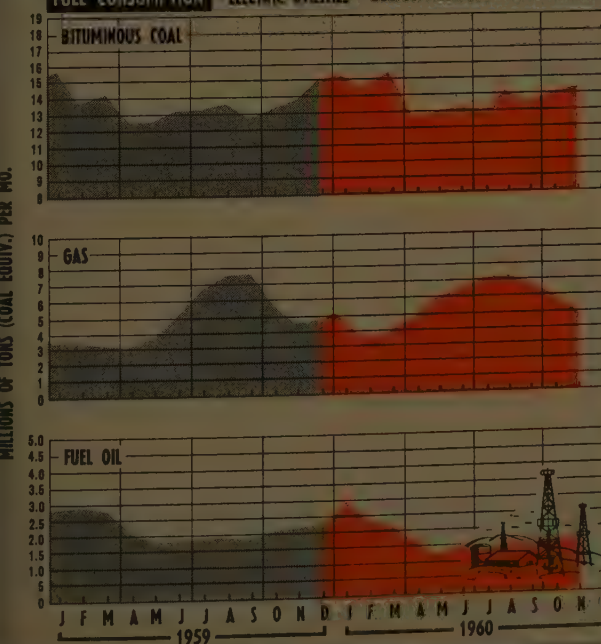
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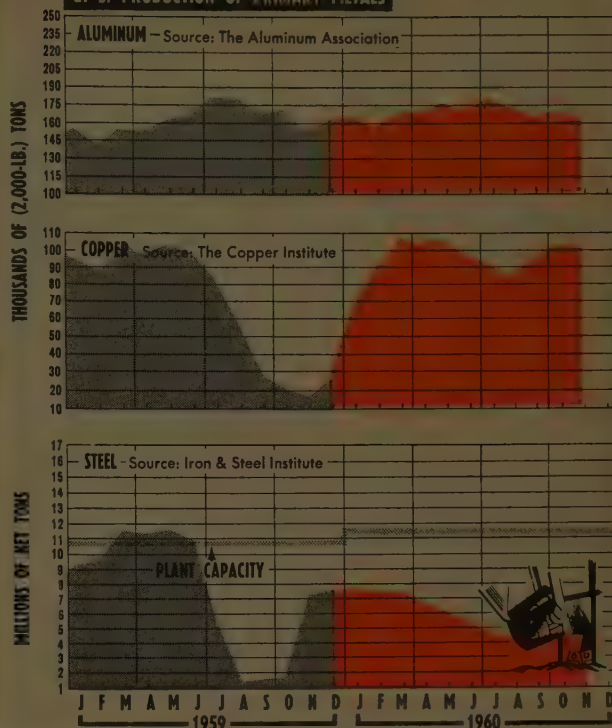
## FUEL CONSUMPTION

ELECTRIC UTILITIES

Source: Federal Power Commission

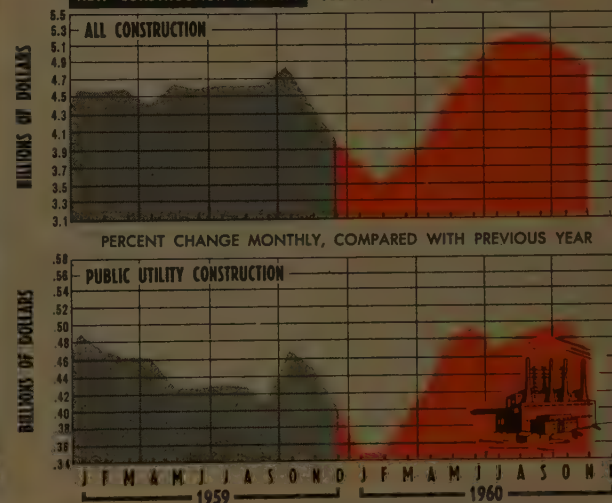


## U. S. PRODUCTION OF PRIMARY METALS



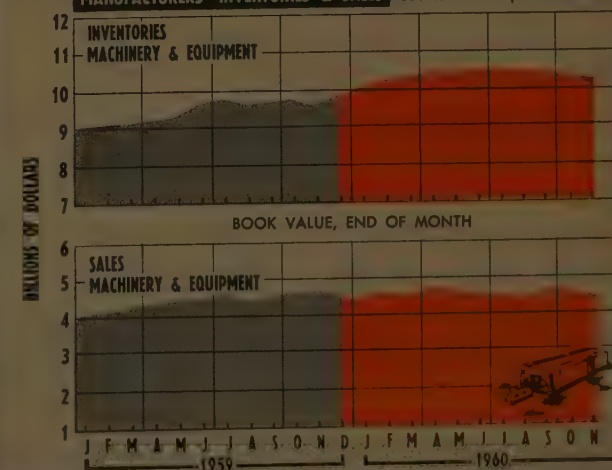
## NEW CONSTRUCTION ACTIVITY

Source: U. S. Dept. of Commerce



## MANUFACTURERS' INVENTORIES & SALES

Source: U. S. Dept. of Commerce







The man who buys coal for an electric utility knows that he must think about 1981 as if it were a lot closer than 20 years away. Because the contract he signs today must embrace his company's coal needs for many years to come. It must contain answers to questions like these:

Can we count on an uninterrupted supply of the kind of coal we must have? Is this coal laden with hidden incremental costs over and above its invoice price . . . in excessive coal and ash handling, equipment outages, freight charges on inerts, and other operating inefficiencies? Or is it coal that will make our burning equipment operate at *highest* efficiency, delivering steam at the lowest possible cost?

Island Creek's approach to these questions shows the same long-term thinking applied by utilities themselves, and the answers are reassuring indeed. We'd welcome a chance to tackle *your* 20-year queries. Write or wire or phone to arrange this important discussion.



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## NATIONAL FUELS POLICY

A comprehensive national fuels policy study — something that warrants close attention by electric utilities — is working its way up to a high level on the Kennedy Administration agenda. And there is slim chance that oil-backed opposition will again hold back the launching of such a study, as it did last year. Thus, around Washington the question has become not one of whether the study will be made, but rather what group will undertake it.

What may develop from the probe, and when, in the form of definitive, enforceable national fuels policy, is purely a guessing matter. Much will depend on the amount of pressure that can be brought to bear in Congress by the powerful forces representing the pros and cons.

Major coal interests have been working for several years toward the formulation of such a policy as a means for obtaining a "fairer" share of the nation's fuel market than they can get under present competitive conditions. Opposing oil and natural gas interests insist that the coal people have their sights set on a substantial build-up of artificial market advantages for coal.

Last year the well organized coal groups barely missed in an attempt to push through legislation to set up a joint Congressional committee to make a fuels study. The bill was nipped by a tie vote in the House Rules Committee. Significantly, several members of Congress from oil and gas producing states testified before the committee just prior to the defeating vote.

Now, however, the picture is a decidedly brighter one for coal. Not only did President Kennedy make a re-election commitment to seek a fuels study, but two of his top advisors have recently submitted strong recommendations for the development of a national fuels policy. James M. Landis, in his report on

the infirmities of the federal regulatory system, pointed out that various agencies and departments are concerned with "segments" of the energy resources problem, but that they lack "coordination of policies" regarding energy use and conservation. Said Landis: "Energy is an area where interaction is essential and where substantially none exists. If we would increase our energy resources and utilize them wisely, coordination both as to utilization and conservation is essential." He urged the creation within the Executive branch of an "Office for the Coordination and Development of Energy Policy."

Recommendation for development of a national fuels policy came in the report by Sen. Paul Douglas (D-Ill.) as chairman of the Kennedy-appointed task force on the currently red hot subject of depressed area redevelopment. The lack of a fuels policy, the report said, is an "underlying reason" for some of the existing distress conditions in coal producing regions "and in some independent oil producing communities."

Coal interests lost no time getting into the act. In a letter to Kennedy, National Coal Association president Stephen Dunn noted his industry's "enthusiastic" endorsement of the task force recommendation, and of-

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**SPEED-UP IN COAL RESEARCH**, authorized for the Interior Department by the last Congress, has been asked by Rep. Aspinall (D., Colo.), chairman of the House Interior Committee. He expressed disappointment in lack of progress under the Eisenhower Administration and voiced hopes for improvement under Kennedy leadership. Federal research to find new uses for coals and minerals was one recommendation of the Kennedy task-force for aid to depressed areas.

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ferred the industry's "full cooperation" in relieving unemployment in coal mining areas. "When the coal industry can again sell more coal," Dunn said, some of the idle miners will be reemployed. But he warned that if coal production is to be increased substantially, "action must be taken to eliminate the unfair practices of coal's competitors."

Dunn questioned "whether it is in the national interest for natural gas, a valuable and relatively scarce resource, to be squandered by use under industrial boilers." Sales of industrial gas, he intimated, are often priced deliberately to undercut coal, with household gas users picking up the tab for "this loss of revenue." He also condemned importation of residual oil, charging that it "imports unemployment to the coal fields."

The oil-gas people had not yet fired any guns at this writing, but were clearing the decks for action.

On Capitol Hill a wrangle has already started over who should conduct the fuels policy study. The chairmen of at least three House committees each has claimed that the task properly falls to his group. Sentiment on the Senate side leans toward the establishment of a special joint committee for the purpose, and the odds are that such a committee will eventually be the chosen vehicle.

Many observers see a distinct possibility of severe friction between Congress and the White House when it comes to the actual laying down of national policy to govern the development and conservation of energy resources, and providing for the administration of such policy.

Although the hammering-out of that policy is some distance down the road, its probable shape could well be reflected in the proceedings of a national fuels policy study.





Postlights located in the front yard of each house automatically turn on at dusk to light the Swanson Highlands community of Gold Medallion homes near South Bend, Indiana. "Magic Eye" postlight turns off at dawn, on at dusk. Each light can be controlled by a regular switch, too.

## Decorative Post Lanterns Solve Residential Street Lighting Problem

*For a few cents extra on their electric bills, residential customers can get street and yard lighting without paying municipal street lighting taxes.*

A SOLUTION to the street lighting problem in outlying residential areas has been adopted by an Indiana real estate developer with benefits to homeowner and power company.

Swanson Homes, Inc. has lighted a 300-home subdivision near South Bend with a postlight in each front yard. The lights are wired to each customer's meter and are equipped with a photoelectric cell that automatically turns the lantern on at sunset and off at sunrise.

Compared to the cost of installing municipal type street lighting, which could be prohibitive, the postlights represent a substantial saving to the developer and are installed without charge to the homeowners. They are available for about \$30 each.

In addition to providing adequate street lighting, the postlights have a "prestige" look that has speeded sales. Nearly 100 fixtures already have been installed at finished houses.

"All those lighted post lanterns in the Swanson Development make an impressive sight and they give off a surprising amount of light," reports Carl Hass, division residential sales supervisor for Indiana & Michigan Electric in South Bend.

The idea was suggested to Harry Swanson of Swanson Homes by Mr.

Hass, in cooperation with Thomas Industries, Inc., Louisville, Ky., manufacturer of the Moe Light photoelectric cell post and lantern, and the first to apply the photoelectric cell principle to post lanterns.

The system is being suggested to other developers. "This answers a lighting problem for home developments in outlying areas," says Mr. Hass, who adds that at least one other builder is already interested.

Mr. Swanson says the cost of in-

stalling the postlights and connecting them by underground cable to the entrance panel of the house wiring system, is about \$15 each, which the developer pays to the electric contractor.

The cost of the dusk-to-dawn street lighting adds a few cents to the monthly electric bills of each homeowner, but he more than makes up the difference in the municipal taxes he does not pay.

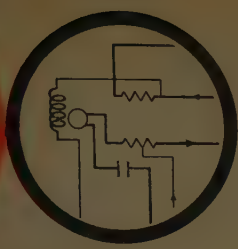
The homeowner also benefits from a number of conveniences. The photoelectric control unit built into the postlight can be connected to other outdoor lanterns up to 100 watts, in addition to the 150-200 watt postlight. And the post has an electrical outlet which can be used to plug in Christmas tree lights or other yard tools.

Indiana & Michigan Electric is promoting postlight sales among homeowners in other neighborhoods. It furnishes a postlight lantern free of charge to the builder of each electrically-heated Gold Medallion Model Home.

Al Lea, sales manager for the Moe Light division of Thomas, states that other utilities throughout the country are beginning to employ the photoelectric cell post and lantern for street lighting, too.







## ENGINEERING-OPERATIONS

### Chopper Saves Months of Road Building

A 2.7-mile-long power line to serve a microwave transmission station high in California's coastal mountains was erected last fall in only ten hours rotor time by a 305-hp Hiller 12E light utility helicopter.

The project, which Pacific Gas & Electric construction officials estimated would have taken a ten-man crew more than a month just to cut a road along the right of way, was the final step toward activating a Pacific Telephone & Telegraph microwave system between San Jose and San Bernardino.

The ten-hour breakdown for the airlift reads this way: four and one-half hours to place 31 poles; four and one-half hours wire laying along the nearly three-mile-long route; and one hour flying involved in transportation to and from staging area, preliminary reconnaissance, and personnel transportation. The entire operation took only three days.

### EE's Job Outlook Still Good

Graduating engineers will fare well when seeking a job this spring, it was disclosed at a job placement conference hosted by Dr. Frank Endicott, Northwestern University placement director. Dr. Endicott's survey of 205 companies disclosed these facts: While industry plans to hire 3.2 percent fewer men with non-technical education in 1961 than last year, it expects to employ 6 percent more engineers. Second, average starting salaries will be up 2.5 percent, with men in business specialties averaging \$450 per month to start, engineers, \$520. Last school year the typical N. U. Tech senior interested in employment in industry took five job interviews, had 2.4 job offers, and received a starting salary of \$536 per month.

### Longest 345-kv Line for Arizona PS

Arizona Public Service expects to begin construction soon on the longest 345-kv line in the United States. The 300-mile-long line will connect the company's proposed Four Corners Power Plant in north-west New Mexico to load centers in Arizona. Steel towers from 100 to 110 ft high will average four and five per mile which will give spans in excess of 1000 ft.

### NSP Lines to Sample Weather Effects

Northern States Power plans to build a test span of transmission lines about a mile west of Mound, Minnesota. Conductors will be of various sizes and types and will be energized at different voltages. NSP is interested in testing and observing the effects of weather on lines located in a lake region such as in the Mound area. Parts of the test spans will be cut down at varying intervals during a five to ten-year

period to study the effect of weather on metallic corrosion.

### HV Line Probes RI and Corona Loss

Radio influence and corona loss are being studied by the new Westinghouse Electric Corp. experimental transmission line at Trafford, Pa. The line is operated at voltages up to 200 kv to ground from the company's high voltage laboratory there. It consists of two sections, end to end: about 1550 ft of 0.721-in. conductor, and 1080 ft of 1.108 in.

The first important investigation made with the new test line was to determine the effectiveness of a new design of decoupling or filter network to isolate one portion of a transmission line from another with respect to RI noise, said J. K. Dillard, manager of electric utility engineering. The T-form filters, consisting of two resistors in series with the line and with the midpoint between them grounded through a large capacitor, was located between the two line sections. One resistor approximately matches the surge impedance of the line; the other is of arbitrary but much higher value to isolate the end of the line section. Noise was generated on the smaller conductor and then measurements made of the noise transmitted through the filters to the large conductor.

"Test results show that the new design will provide a high degree of RI isolation between line sections, and we expect similar units to contribute significantly to investigations we will make in the near future on an EHV test project the company is now engaging in at another location," Mr. Dillard said.



This portion of the experimental high-voltage test line shows two of the filters first tested. In the future, the line can be used to study other areas involving RI and corona loss. These include fundamentals of corona generation, RI wave propagation, improved instrumentation for measuring and studying RI and corona losses and new ideas for suppression or reduction of these losses.



# NATURAL HAZARDS AND THE UTILITY INDUSTRY

## *A World Wide Report on a Not-So-Cold War Between Electric Utilities and Nature*

By LEWIS E. DICKINSON  
Kaiser Aluminum & Chemical Corporation  
Bristol, Rhode Island

### About the Author . . .


Lew Dickinson is uniquely qualified to write about wild life influence on utility installations. His avocation is conservation, he is president of the Audubon Society of Rhode Island and he has been associated with the electric wire and cable business for 36 years.

This particular article, written especially for **ELECTRIC LIGHT AND POWER**, actually germinated some four years ago when Mr. Dickinson was observing a frustrated bluebird trying to alight on a high-tension line. He concluded that an electrostatic field was keeping the bird from landing and this led him to investigate other such phenomena involving birds and power lines. An article on this subject appeared in a national conservation magazine in 1957.

Reaction to that study was so favorable that he began a survey on a world-wide basis covering the effects of all forms of wild life on wire and cable installations.

"By working through embassies," he comments, "I was able to write to one or more utilities and electrical commissions in most countries throughout the world. The response was gratifying. While recounting their problems with wild life, they often suggested remedies. In the case of animals and birds, it was evident that most engineers were anxious to solve the difficulties, not only to prevent interruptions in circuits, but also to provide the least amount of interference with nature."

During Mr. Dickinson's long tenure in the electrical industry, he has served in various management positions involving wire and cable production, engineering sales and administration. He has been with Kaiser Aluminum at the Bristol, R. I., plant since early 1957.



Gopher attack on neoprene and rubber insulation.

**T**HERE is a quiet but relentless struggle going on between nature and man in his attempt to transmit and distribute electricity. Generally, man with his engineering prowess seems to be winning, although nature continues to attack in strange ways.

In this article the accounts of damage by animals, birds, insects and vegetation were gathered from every major country and many other little-known places on the globe. Some of the accounts point out solutions to fairly universal problems while others, although of considerable interest, hardly suggest an immediate threat to American utility installations.

### Animals

For instance, in Northern Transvaal the giraffe used to give utility engineers (and themselves) a major pain in the neck until it was decided that all overhead conductors would have to be strung with at least a 20-foot clearance in certain areas. And in the Congo, the possibility of elephants rubbing against the towers used in the transmission of power to the copper mines has to be taken into account when the towers are designed and constructed.

In both Costa Rica and Australia opossums cause a lot of trouble by climbing guy wires or poles. The practical solution to this problem is





Overhead power line crossing a river in Ireland. Conductors are strung with corks to warn away swans which would otherwise dash themselves to death against the conductors.

Swans with cygnets in Ireland. These swans would dash themselves to death against unmarked conductors crossing the river along which they fly regularly.



Bird nest containing bare metal wire. This nest was removed from a power line.

the application of metal discs (aluminum or steel) to the guy wires or nailing a 24-inch strip of aluminum sheet around the poles.

From the Panama Canal Zone, come accounts of sloths climbing transmission towers into overhead 44,000-volt transmission lines causing them to relay with consequent service outages. The unusual feature here is that single contacts rarely prove fatal to the sloths and there have been occasions where the same animal survived three such contacts in the same night. So far as we know, no means have been found to overcome this problem.

From Australia, comes a plea to suggest a repellant which can be mixed in neoprene to prevent gnawing by wombats of cable which is trailed overground. This is, of course, the old familiar problem of protecting cable from rodents, and all of the information which we have received to date from the four corners of the globe indicate that armoring is the only solution. Gnawing of wires and cables by rodents is usually done because the wires and cables are in the path of the rodent—not for food value.

In Canada, some difficulties are experienced with porcupines which want to chew most anything. Here armoring would seem to be the only solution if cables are attacked.

Also, from the same area, beavers occasionally drop a tree on a power line. The most humane remedy here is to trap the beavers alive and transport them to another area.

### Birds

Impact with overhead lines causes mortality of many of the larger birds. From Austria we hear that frequently as many as 30 telegraph wires form a wire wall at a height of about 12 feet above ground, and many birds are found under these lines which have been killed by flying against them. In this particular case, no effort to reduce the damage to the birds was taken.

Contrast this to a condition in Ireland where swans regularly fly up and down the rivers. When wires are strung across these rivers, corks are usually put on one of the lines so that the flying swans can see and avoid them.

Of course, all countries have problems where large birds contact bare power lines and are electrocuted. This has often been taken care of by widening the span between lines or by changing the configuration of the lines to a triangular shape rather than the conventional horizontal configuration.

Building of nests on poles and towers causes trouble the world over. The Otter Tail Power Company at one time put artificial kingbirds on the lines near where crows

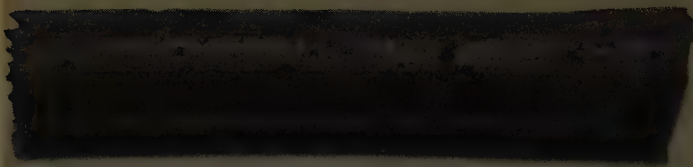
were building nests and this tended to discourage building of nests. (Kingbirds will attack crows at the least provocation.)

It is usually when these nests become wet that shorts occur. However, from both Germany and the United States come reports that pieces of bare metal wire are being used frequently in these nests and this, of course, makes it an all-weather hazard. Actually, many reports indicate that birds are often electrocuted while carrying pieces of wire for nesting purposes.

Various things have been done to discourage birds from building nests on towers and poles. In Argentina, Chile and some parts of Brazil the "oven bird" builds nests on the cross-arms of telephone poles. The companies protect the poles by putting scratch brushes in between the wires so that the bird cannot light on the arm to start its nest. In this country when fish hawks have built nests on poles, companies have been known to put up special poles for the benefit of the birds. In Denmark storks are regarded with so much attachment that engineers, whenever possible, move the wires down the poles, leaving the top to the visitor.

In Johannesburg, South Africa, droppings of various types of birds prove to be troublesome. These birds perch on cross-arms immediately above the insulation string,





Results of termite attack on control cable with neoprene jacket.



Wire cloth installed over a telephone pole to prevent attacks by woodpeckers.

foul the latter and so cause flashovers. They now attach a few short pieces of wire sticking out, hedgehog-fashion, at the point at which they wish to discourage perching and this has proved to be very effective.

In Australia, birds are often blamed for causing flashovers of transmission line insulators by fouling the insulators with droppings, but there is also a school of thought which attributes these faults to a dew effect, as they occur in the early morning within a few minutes of sunrise.

Of course, everyone in the industry is familiar with the damage done to poles by woodpeckers. Various methods have been used to reduce this damage. Ropes have been hung on poles to give the effect of snakes. Wire netting has been put around poles so that the birds could not get a good grip for chiseling into the poles. Concrete and aluminum poles have been used.

A new and interesting type of damage by woodpeckers was reported from West Central Texas. Telephone cables used in this area consist of the insulated conductors, covered with a thin sheath of aluminum, over which polyethylene is extruded. Woodpeckers pecked holes through the polyethylene permitting the entrance of moisture.

From Israel we were told of trouble from small birds on newly installed transformer air-gap protectors. The protectors represent two horns of about  $\frac{1}{3}$ -inch thickness facing each other with their ends and separated by a gap of about 4-5 inches. Owing to the small diameter of the horn and its vertical arrangement, the lower end should

have been an undesirable place for a bird to sit upon but as a matter of fact some small birds preferred to sit there and get electrocuted, causing fuses to blow and often interrupting service. The ends of the lower horns were fitted with short lengths of glass tubes which provided too weak a grasp for comfortable sitting and actually disturbances were lessened. They are now going to experiment with some pointed glass terminals on the lower horn ends which might be more effective.

From Finland comes a report that wires were swung by birds, when they flew away, causing contact between the wires. These are no doubt cases where there was insufficient clearance between wires.

#### Insects

From Taiwan, we received a report that lead-sheathed aerial cables are most seriously attacked by local species of wasps and other insects. They are experimenting with a chemical coating over the lead sheath containing five percent Dieldrin and five percent Pentachlorophenol. Also, over some sections of the island where the insects did the most damage, they have protected the lead with a layer of coal tar over-wrapped with bronze wire armor.

Also, from Taiwan came reports on measures taken to prevent termite damage to cable. In some cases, they have coated underground cable with Pentachlorophenol with no damage to date over a period of two years. Also, the same technique used for rodent proofing cable, that is, the use of a metallic ribbon, has been in effect for several years with perfect protection to date.

On the other hand, from Australia we get word of another method of termite-proofing cable. Here the damage consists of a number of small holes gouged through the lead sheath of multi-wire cables for telephone systems. Considerable success in overcoming such damage has resulted from the use of a vase line-based serving containing arsenic which is applied to the outside of the lead sheathing. It might be well to mention here that others have considered this but have decided against the use of arsenic.



Also, in Australia rapid attack on plastic sheathings by termites have led up large-scale utilization of plastic-sheathed cable in the tropical regions.

From the Panama Canal come reports of underground power cable failures due to termites. It appears that the only cables attacked are those employing jute fillers.

From Hawaii we get this interesting report on termites:

"Our greatest trouble is with our underground cables. Some of our underground cables are insulated with paper which is kept dry with lead sheath. Other underground cables are insulated with synthetic rubber or polyethylene, usually with a neoprene jacket. Termites will eat through the synthetic rubber, polyethylene or neoprene with relative ease. They have occasionally eaten through the lead, but that is unusual. Underground cables are either installed in underground ducts built especially for such services or buried directly in the ground. For cables installed in underground ducts, the ducts are treated before the installation of the cables by blowing Pentachloronate, chlordane or paris green into the ducts. Paris green is used for all polyethylene or neoprene cables, but because paris green will attack lead, Pentachlorophenate or chlordane is used with lead cables. For direct-buried cables, the ground adjacent to the cables is treated with either Pentachloronate or chlordane. Because of its toxic qualities, paris green is not used here."

Cuba reports they had trouble with the first underground cable of the synthetic insulation type which was installed around 1933. After two or three years of service, this cable started to fail and upon investigation of the cause of failures, they found out the insulation had been eaten in spots by a type of ant. It was necessary to replace all cable of that type.

A termite hazard which we would not encounter here is mentioned from the Congo. "Anthills" can grow too close to the lines so that the clearance to ground becomes dangerous. These "anthills" must be removed, partially or completely.

An interesting note from Ran-

goon states that cockroaches appear to be peculiarly attracted to certain varnishes used in the manufacture of insulating tapes. It is owing to this that they never use yellow varnish.

### Vegetation

A report from Russia states that when the roots of a tree come too close to a cable, the latter may be damaged by lightning if lightning hits the tree. Screening bars placed around the roots are used for protection in such cases.

In Ghana the roots of Nim trees occasionally spiral around a cable, gradually deforming the cable.

An interesting observation from the Dominican Republic states that when lines go over sugar plantations in the time of the sugar crop, some short-circuits occur when vegetable matter is blown by the wind against the lines. The only precaution against this is maintaining the narrow paths under the lines properly clean, pruning the trees and chopping down the bushes.

This, of course, brings up the question of cleared areas under transmission lines in many countries. Some countries keep this clear by cutting only, some by spraying and some by a combination of both. In late years, it has been suggested by some that selective spraying be used which would keep the right-of-way clear enough for repair purposes and yet allow certain types of vegetation to grow to provide wild life habitat. When the mileage of these relatively narrow rights-of-way are considered, the acreage involved is tremendous and would add up to a valuable addition to wild-life habitat.

In India, creeper plants often use stray wires or poles as supports, and rising up to the conductors cause faults.

From Venezuela, we had this report:

"We wish to inform you that the only interference we have suffered here in Caracas is the growth of a type of wild grass on cotton covering of overhead wire. In the earlier days, when we used wire which had an outer braid of cotton, the plant seeds became wind-borne and lodged in the interstices of the

braid, where the plant grew until the wire appeared to have grass divots on it at 10- to 30-inch spacings. From time to time, it was necessary to clear this plant by means of a rope thrown over the wire and drawn from one pole to the next. This trouble naturally has not arisen with the use of line wire with polyvinyl chloride (PVC) covering, which we now employ, since the covering is smooth."

From Jamaica we learn that Spanish Moss grows on aerial lines when there is a fabric covering on the wire. Bare wires or wires insulated with plastic material do not support this growth, although they have lately found traces of this plant on bare aluminum wire which has a coating of protective grease. The growth does not cause any real trouble, although it is, of course, somewhat unsightly.

Puerto Rico also reports aerial growth on overhead conductors (other than plastic-covered) and they say it causes additional sagging and wind load during storms. They also say this aerial plant is starting to grow on ACSR after 25 years of service.

Perhaps the one thing that most people in this country are cognizant of is the effect of aerial lines on shade trees in towns and cities. Surely good public relations requires that a minimum of damage be done to trees through which electric lines must pass. Several companies have published very informative booklets on the types of trees which have decorative flowers and foliage, provide good shade, yet are properly shaped to give minimum interference to overhead lines.

### Conclusion

It might be well to note that while some countries have special problems, much can be gained by knowing the other fellow's problems.

This investigation has led us to think that a conservation committee might well be set up within the utility industry to accumulate information of this type and disseminate it to manufacturers and users of electric wires and cables. It would unquestionably contribute substantially to the cause of conservation, and would be first-rate public relations.





# SHORT-RANGE PEAK SYSTEM PLANNING

*Rate-of-growth factor coupled with historical overall deviation of actual annual peak loads provides sufficient data for reasonably accurate predictions.*

By W. L. CAREY, Planning Engineer,  
Portland General Electric Company

Predicting with reasonable accuracy what one's system peak load will be one or two years ahead is essential to short range system planning and to preparing construction budgets. (The load referred to is the annual maximum one-hour integrated demand for the entire system in kilowatts). However, obtaining any degree of accuracy in such predictions appears somewhat remote when considering the many variable factors that affect peak load. Further, little help can be expected from a review of previous system peaks. For example, in the last ten years PGE's system peak load has ranged from a negative growth of 0.2 percent to a positive growth of 18.3 percent.

## Method

Some of the many factors that affect peak load are load growth, temperature, wind, sunset time, sky cover, economic conditions, voltage, and day of the week. Only one of these factors, however, has a cumulative effect on load and that is load growth. The effect of any of the

other factors on load, over a period of years, is zero.

After plotting week-day peak loads, against these various factors, it was found that the best correlation was between peak load and daily mean temperature. January peak loads were used since this is the month in which seasonal peak load usually occurs. Temperature information was obtained from the weather bureau.

Fig. 1 shows the January week-day peak loads plotted against their respective daily mean temperatures for each year since 1947. The straight line drawn through each year's group of points was arrived at by the method of least squares. Highest peak load for each January is circled to show what happened to the seasonal peak load in relation to the other week-day peak loads.

Salient features of Fig. 1 are as follows:

1. Slope of each line is temperature-sensitive for that year.
2. Space between successive lines is the apparent peak load growth for that year.
3. Deviation of loads about each straight line is the combined effect of all remaining factors.

## Analysis

Data on which Fig. 1 is based enables us to write the following general equation:

$$P_n = P_o (1+r)^n - (S_o + gn) (T - T_o) + Kf(x)$$

$P_n$  = annual peak load  $n$  years in the future

$P_o$  = initial annual peak load

$r$  = annual growth in per unit

$S_o$  = initial heat sensitivity in m per °F

$g$  = annual growth of heat sensitivity

$T$  = actual daily mean temperature °F

$T_o$  = reference daily mean temperature °F

$K$  = constant

$f(x)$  = combined effect of all remaining factors

The first term in the above equation indicates that the load is increasing exponentially with years. The second term shows that the load varies directly with temperature and that this effect is increasing with time. The third term is the combined effect of all remaining factors.

Appendix I shows the detailed analysis of this equation, using p

Editor's Note—This is an adaptation of a paper presented by the author at a recent AIEE General Meeting.



# LOAD PREDICTION METHOD AIDS

1. derivatives and standard deviations. Results are as follows:

Temperature causes a deviation peak load of  $\pm 4.6$  percent.

2. Erratic annual load growth causes a deviation of  $\pm 3.4$  percent.

3. All remaining factors combined cause a deviation of  $\pm 2.9$  percent.

4. Combined effect of all the above factors would be a deviation of  $\pm$  percent.

The combined deviation of  $\pm 6.4$  percent obtained from the equation compares reasonably well with the actual deviation of  $\pm 5.4$  percent over the last 10 years, when considering the limited number of points which the comparison is based. The combined deviation of about 6 percent appears to be reasonable.

All of the above deviations are based on a bandwidth such that in only one year out of 10 will actual load exceed predicted load by more than this deviation. If we were interested in finding the load which could be exceeded only once in every 25 years, we would add 8 percent, rather than the 6 percent above. All of the other percentage deviations would also be increased the same ratio.

## Negative Results

At first glance it may be discouraging to try to use the above information for short-time load predictions. For example, while we have shown a correlation between peak load and temperature and between peak load and rate of growth, we are still no more able to predict growth rate or temperature two years in advance than we are to predict the load itself. However, we can arrive at what we should not do and that is to write an equation of future peak loads as a function of temperature, wind, or any other non-predictable, non-cumulative factor. We could stick to the only factor that we know has a cumulative effect on

system peak load, and that is rate of growth. This factor along with overall deviation of actual annual peak loads should be used in an equation for short-time load prediction.

## Positive Results

The following exponential equation can be used for short time load predictions:

$$P_n = P_o (1 + r)^n (1 + d/100)$$

$P_o$  is the value of peak load to be used for the last known year, and  $r$  is annual rate of growth. These two factors are determined by first finding the intersections of the lines of regression with the most probable minimum daily mean temperature on the plot of peak load vs. temperature. These intersections are shown in Fig. 1.

The method of least squares is then applied to these intersections over the previous ten-year period to determine both  $P_o$  and  $r$ .

If too short a period is used as a basis for determining rate of growth, results will be too erratic; if too long a period is used, factors will be included that may not be desirable, such as the effect of major wars, depressions, etc.

Selection of the 10-year period was purely a matter of judgment, and herein lies the possibility of a further study to determine the optimum period. This would be found by minimizing the deviation between actual rates over the past history of the company.

"d" is the percent total deviation as presently determined, and depends on the degree of risk desired. Table I is based on a normal distribution curve and shows relationship between risk and deviation.

## Advantages

Primary advantage of predicting future loads by this method is that no one single week-day peak load is given undue importance.

The error in considering only one daily peak load for each year can be observed by again examining Fig. 1. For example, the January, 1949, peak load was 406 mw, eight percent higher than the January, 1948, peak of 376 mw. This would seem to indicate an eight percent growth in load. However, an examination of intersections of lines of regression with the most probable minimum daily mean temperature for these two years indicates an apparent growth in load of only 2.7 percent, with the remaining increase caused by a colder winter.

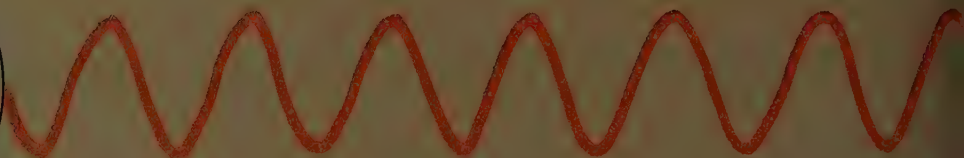
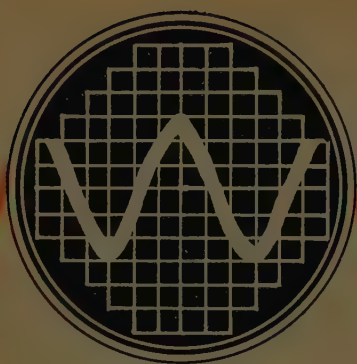
Conversely, January, 1958, had a peak load of 782 mw, only 0.4 percent more than the 779 mw peak of January, 1957. An examination of the lines of regression of Fig. 1 for these two years indicates that the system had an apparent growth of 8.9 percent and that lack of increase in peak load was almost entirely due to warmer winter temperatures.

Another advantage of this method is an appreciation of the magnitude of deviation between actual and predicted loads, and an appreciation that this deviation will increase as temperature sensitivity increases. This means that as more and more temperature-sensitive loads, such as house heating, are added the more erratic and unpredictable the annual peak load will become.

Present sensitivity of our load is about four mw per degree F, increasing at a constant rate of about 0.3 mw annually. The deviation chart of Table I will consequently have to be revised periodically to take account of this change.

Still another advantage of this method is that it develops the relationship between ambient temperature and peak load. Although this relationship is not directly useful in predicting peak loads, it is useful in determining equipment loading policies, since equipment thermal ca-





capacity also varies with ambient temperature.

### Summary

Following, is an outline of the method of predicting short range peak loads:

1. Plot week-day loads  $P$  vs. the respective daily mean temperature  $T$  for the peak load month of each year over the last 10 years. (Fig. 1).

2. From weather bureau records determining the most probable minimum daily mean temperature for peak load month over the past available history. See Fig. 1.

3. Determine line of regression of  $P$  vs.  $T$  and the intersection of this line with the most probable daily mean temperature. Intersections are indicated on Fig. 1.

4. These intersections, the most probable peak loads for each year, can then be plotted vs. years on semi-log paper. Fig. 2.

5. Determine line of regression of the most probable peak loads vs. time, which will show short-range load predictions. Fig. 2.

6. Determine standard error of estimate as described in Appendix I. This consists of determining error due to each of several factors separately, then combining them.

7. Apply a normal distribution curve to errors found in Step 6. (Shown in Table I.)

8. Express factors found in Step 5 and 7 in the equation:

$$P_n = P_o (1 + r)^n (1 + d/100)$$

where

$P_n$  = predicted peak load at year  $n$ .  
 $P_o$  = initial peak load found in Step 5.

$r$  = annual rate of growth found in Step 5.  
 $d$  = deviation found in Step 7.

Although the emphasis herein is entirely on peak loads, our experience indicates that the same method

can be applied to energy predictions.

### Appendix I

General Equation:

$$P_n = P_o (1 + r)^n - (S_o + gn) (T - T_o) + Kf(x)$$

The particular equation for prediction two years in advance only is:

$$P + P_o (1 + r_2) - S_2 (T - T_o) + Kf(x)$$

Where  $r_2$  is the biennial growth rate and  $S_2$  is heat sensitivity predicted for two years in advance.

The error or deviation of the predicted load  $P$  due to deviation of any one single factor is  $\Delta P$ . To determine  $\Delta P$ , multiply the partial derivative of  $P$  with respect to that factor by the deviation of the factor. This can be done for each factor as follows:

1. Deviation due to temperature is:

$$\Delta P_T = \frac{\partial P}{\partial T} \delta_T = S_2 \delta_T$$

2. Deviation due to growth is:

$$\Delta P_r = \frac{\partial P}{\partial r} \delta_r = P_o \delta_r$$

3. Deviation due to temperature sensitivity is:

$$\Delta P_s = \frac{\partial P}{\partial S} \delta_s = (T - T_o) \delta_s$$

4. Deviation due to all other factors combined as one factor is:

$$\Delta P_x = \frac{\partial P}{\partial X} \delta_x = K \frac{\partial f(x)}{\partial X} \delta_x$$

To evaluate these partial derivatives the desired degree of accuracy must be decided. As an example, let's say that the degree of accuracy must be such that in only one year out of ten will actual load exceed predicted load. Required deviation for this accuracy is 1.28 times standard deviation, based on a normal distribution curve.

Using this information, the partials have been evaluated for the year 1958 as follows:

1. Heat sensitivity  $S_2$  in 1958 was 3.9 mw/°F. Temperature deviation times 1.28 based on 48 years weather bureau records is  $\pm 9$  degrees F.

$$\Delta P_T = 3.9 (\pm 9.6) = \pm 37.4 \text{ mw}$$

2.  $P_o$  based on line of regression of most probable loads for 1956-695 mw. The biennial growth rate from the same line of regression is 17.7 percent with a standard deviation of 3.1 percent. This standard deviation times 1.28 gives a deviation of 4.0 percent. Thus,

$$\Delta P_r = 695 (\pm 0.04) = \pm 27.8 \text{ mw}$$

3. For the most probable temperature, the temperature  $T$  equals the reference temperature  $T_o$  and  $\Delta P_s = 0$ .

$\Delta P_s$  has a value only when we attempt to predict the load for some temperature other than the most probable temperature.

4. Since the form of  $f(x)$  is unknown,  $P_x$  cannot be evaluated the usual way. The deviation of load due to all remaining factors,  $P_x$ , has been evaluated from Fig. 1, by finding the percent deviation of all 24 points from their respective line of regression. Multiplying this standard deviation by 1.28 is  $\pm 2.94$  percent, so that by 1958:

$$\Delta P_x = 815 (\pm 0.0294) = \pm 24.0 \text{ mw}$$

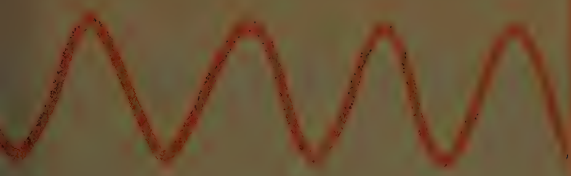
To find the resultant deviation peak load from all the factors acting simultaneously, individual deviations are combined as follows:

$$\begin{aligned} \Delta P_{\text{Total}} &= \sqrt{(\Delta P_T)^2 + (\Delta P_r)^2 + (\Delta P_s)^2 + (\Delta P_x)^2} \\ &= \sqrt{37.4^2 + 27.8^2 + 0^2 + 24.0^2} \\ &= \pm 52.4 \text{ mw} \end{aligned}$$

This amounts to  $\pm 6.4$  percent of the most probable 1958 peak load of 815 mw.

Over the last ten-year period, the standard error of estimate of the





actual peak loads is  $\pm 4.2$  percent; 1.28 times this value gives a deviation of  $\pm 5.4$  percent, which compares reasonably well to the above  $\pm 6.4$  percent considering the limited number of points on which the comparison is based.

The multiplier of 1.28 has been used throughout in order to establish a particular degree of risk. For different degrees of risk, different factors can be found from tables based on a normal distribution curve. This has been done and the results appear in Table I.

Appendix II				
Year	1	2	3	4
1947	26	326	322	334
1948	42	376	370	362
1949	28	406	380	397
1950	18	472	434	428
1951	38	471	487	463
1952	27	522	512	501
1953	41	507	531	544
1954	22	600	576	588
1955	36	633	633	638
1956	23	718	683	695
1957	21	779	752	752
1958	39	782	819	815

1. Daily mean temperature on peak load day degrees F.
2. Actual peak load in mw. Indicates a growth of 8.1 percent and a standard error of 4.2 percent.
3. Most probable peak load for each year. Indicates a growth of 8.5 percent and a deviation of 2.6 percent. These are the intersections indicated on Fig. 1 and plotted on Fig. 2.
4. Points on line of regression based on Column 3.

### Bibliography

1. "Statistical Methods," Herbert Arken and Raymond R. Colton, College Outline Series
2. "Standard Handbook for Electrical Engineers," A. A. Knowlton, Section 3-375

TABLE 1 DEVIATION OF ACTUAL PEAK LOADS FROM PREDICTED VALUES	
NUMBER OF TIMES PREDICTED LOAD WILL BE EXCEEDED	PERCENT DEVIATION $d$ TO USE IN PREDICTION FORMULA
1 YEAR OUT OF 2	0
1 YEAR OUT OF 5	4
1 YEAR OUT OF 10	6
1 YEAR OUT OF 20	7
1 YEAR OUT OF 25	8

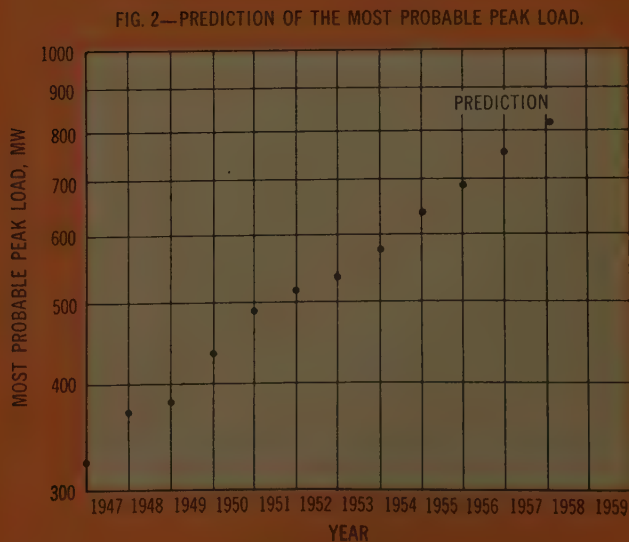
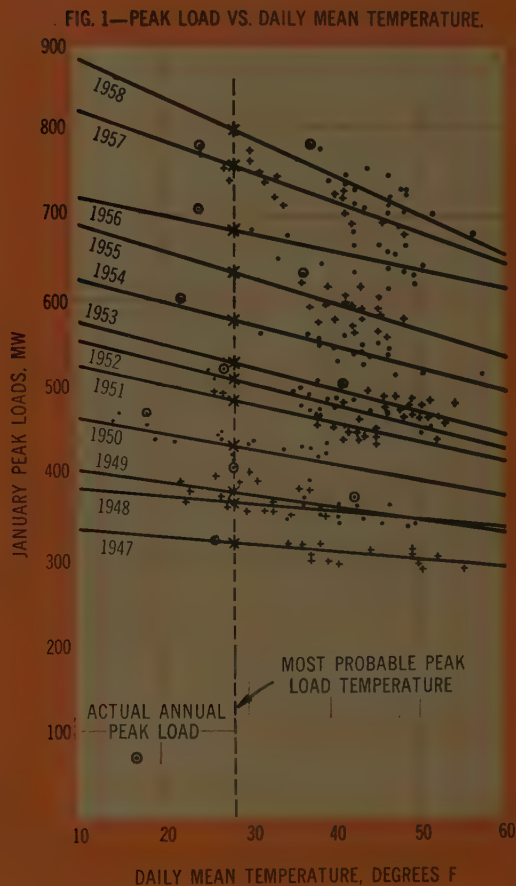






Fig. 1—Interior view of mobile instrumentation and control center.



# FIELD INVESTIGATION OF BREAKER PERFORMANCE

*Power circuit breaker testing experience on the BPA system over a period of nearly 20 years has shown that there are many problems to be overcome in conducting and interpreting such tests.*

By E. C. STARR, Chief Engineer

and E. J. HARRINGTON, Test & Development Engineer, Bonneville Power Administration

MUCH HAS BEEN LEARNED on the BPA system as to what constitutes a thorough investigation of breaker performance as well as what procedures must be followed in order that accurate records depicting that performance may be obtained.

This report is an effort to present, in brief form, a number of the more important factors which, in the authors' experience, must be considered in conducting tests on an operating power system.

Due to limited space much of the report is presented in outline form with elaboration only of those parts where such detail is considered of value.

Performance of full-scale fault interruptions are usually to: verify assumed extrapolation of laboratory test data, give final assurance that a particular design is adequate, and to provide data that are difficult or impossible to obtain in the laboratory, as for example, kilometer-type faults [1]. (This term is used herein to designate that type of fault a relatively short distance away from the station bus that produces, under certain conditions, very high rates-of-rise of recovery voltage.)

Performance of line-dropping and shunt capacitor or cable switching tests are conducted for similar reasons, viz: to check laboratory

results and to secure data under conditions difficult to duplicate in the laboratory such as long lines, low impedance bus, corona decrements, etc. Calculations may be checked, analogs devised or other approaches verified from field test data. In addition, meaningful and searching laboratory tests are made possible through knowledge gained during field testing.

For various reasons, fault-interrupting tests are usually scheduled for performance at or near generating stations. Ability to adjust voltage and fault capacity of the site to the desired values are two of the principal factors as are also the ability to obtain the desired recovery voltage characteristics and decrements of d-c and a-c components. When these desired conditions can be met at several locations the choice may be determined by additional factors, such as: accessibility, physical and electrical clearances, ease of set up, effect upon the system, etc.

Capacitive current interruption test sites are chosen such that line-dropping tests may be made against a low impedance bus, i.e., one giving minimum initial recovery voltage or having minimum transient voltage regulation resulting from the charging current switching required. This applies also to cable and single capacitor bank switching tests. Tests involving switching of one capacitor group against others (parallel or back-to-back switching) are better made from a low

impedance bus although this is not so critical as in the single bank case.

## Instrumentation And Control

Instrumentation for tests at various locations on a widespread system demands portability of equipment, ease of set up plus independence of power, lighting and water supplies. Figure 2 shows an exterior view of the mobile instrumentation center used for tests on the BPA system. This is used in conjunction with an auxiliary unit which contains power-driven reels for instrument and control leads, a gas-driven 25 kw power supply plus tools and workshop facilities. Figure 1 is an interior view of the instrument center. Herein are cathode-ray and magnetic oscillographs, voltage amplifiers, timing and sequence control equipment, communication and public-address systems, relays, coordination timers, calibration facilities and plug and jack panels to facilitate set-up of circuitry. Photographic darkroom, water and air-conditioning facilities do not show in the picture.

Accuracy of measurements is of prime importance. Essential to achievement of accuracy is the prevention of introduction of variables from extraneous sources. Many of these errors can be reduced to negligible proportions by: proper routing and shielding of instrument leads, proper equipment grounding, transmission of data at maximum permissible levels, use of adequate

Editor's note—This is the essential text of a paper prepared by the authors for the CIGRE Convention in Paris June 15-25, 1960.





Fig. 2—Mobile instrumentation and control center for power system field tests.

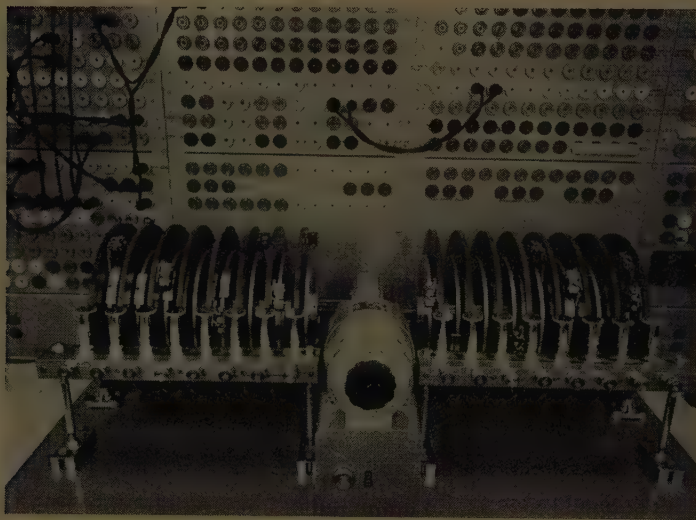


Fig. 3—16-channel, synchronous motor-driven sequence control device.

current transformers, reversing direction of asymmetry for successive tests, attention to impedance termination of high-frequency cables, adequate voltage-divider design and accurate shunts not susceptible to stray pickup.

Of prime importance also is accurate and properly functioning recording equipment capable of producing good records. Calibration procedures should be standardized and oscillograph elements, their order and deflection, should be

chosen for minimum error and ease of analysis. To this end, excessive deflections, mechanical bias, overlapping of traces, etc., should be avoided. All equipment must be well maintained, i.e., optical systems kept clean and adjusted, new lamps used, proper voltages applied, etc.

**Control equipment.**—Suitable control equipment is essential not only for proper test timing and sequence but also for adequate system and personnel protection.

Reliability is a prime requisite and for this reason the authors favor mechanical-electrical device over electronic timing and sequence control. Any electronic gear, if used, should be "fail safe" if possible and components of the highest quality should be used and not overstressed.

The sequence control equipment should have positive "lock out" after one sequence. All control of equipment critical to the system or personnel safety should have one or more stages of back-up protection.

In addition to reliability, accuracy of control is of major importance. This applies in particular to fault initiation and test breaker tripping controls which should be consistent to within a few electrical degrees. All sequence controls should be capable of being preset and of specific incremental variability without loss of accuracy.

All but the simplest of tests are best performed by fully automatic control. This means that all events and their sequence such as oscillograph start, fault initiation, breaker trip, etc., will take place automatically and at the proper times once the manual start signal has been given. To accomplish this the number of control channels must be sufficient to handle any degree of complexity encountered and the timing range of sequences should be from a few electrical degrees to several seconds.

Fig. 3 is a view of the sequence control contained in the mobile instrumentation center in use by BPA. Synchronous motor-driven cam-operating high-accuracy microswitches are used. Cam positions are variable and 16 channels are provided. The microswitches control mercury relays, which in turn do the actual circuit switching. The present device is driven by a reluctance-type synchronous motor which will soon be changed to a permanent-magnet type for increased accuracy. This unit in combination with telephone-type step-per relays and event timers covers a range of sequence from ten seconds down to a few electrical degrees.

**Oscillographs.**—For important tests a minimum of two magnetic



type oscillographs are considered necessary to insure reliability. To this end the most essential quantities should be duplicated on both oscillographs. For legibility it is preferred that not more than 12 traces be recorded on 10-inch-width material. Such oscillographs should have automatic record numbering, audible lamp burn-out signal, constant speed with a wide choice of ranges, marginal timing lines, high writing rate and an excellent optical system that includes illumination with a minimum of stray light to prevent record fogging. Of considerable merit is high dielectric strength between channels that may prevent breakdowns due to inadequate shielding of incoming circuits. (While such potentials are better left in the switchyard, they are sometimes brought in inadvertently.)

One or more cathode-ray recording channels are essential if high-frequency or medium-high-frequency phenomena such as recovery voltages are to be recorded. Three channels are a desirable minimum. On such oscillographs, if drum-type record magazines are used, positive and absolutely reliable unblanking and blanking of the beam is a necessity. This applies to both the oscillograph proper and all allied control circuitry.

The authors find that for moderately-high-frequency recording, the continuous paper or film drive magazines are more reliable and much less critical as to timing. For certain types of tests, preliminary set-up, timing and equipment checks, one or more single-channel or dual-channel cathode ray oscilloscopes with fast developing camera attachments are useful.

**High-speed cameras.**—Such auxiliary equipment is probably most useful in the research and developmental field although it is often the case that some research or similar investigations may be combined with breaker tests. As an example, investigation of arc phenomena and deionization times can be readily combined with breaker fault interrupting tests. The high-speed camera in addition to its application in such fields will be found of value during breaker tests to record deflections due to shock, gas, oil or flame expulsion, linkage deflections,

latch behavior, etc. In conjunction with an oscilloscope it may be used to simultaneously record both electrical and mechanical or other visual phenomena.

A 16 mm film size is usually adequate as is a 100-ft magazine capacity. A maximum frame speed of 4000 frames per second will accommodate most mechanical investigations. Lighting will be found very difficult for greater frame rates. Arc phenomena and other self-luminous objects can utilize frame rates of 8000 per second and higher and impose no lighting problems.

### Shielding And Prevention Of Error Potentials

**Electrostatic sources.**—Electric fields are sources of error when permitted to terminate on instrument leads of recording equipment. Equipment location should be so chosen as to minimize such fields. The use of coaxial or triaxial cable for instrument leads with proper grounding of shield conductors is usually effective. Faraday-type of shielding for instruments is usually adequate. Resistance-type voltage dividers should pass sufficient current to minimize capacitively coupled errors.

**Electromagnetic sources of error.**—Error voltages due to such sources impose the most difficult shielding problems. Although the mutual coupling between instrument leads and source of flux may be very low, very high rates of change of flux may be encountered. This coupling should be kept to a minimum by avoiding parallels between leads and bus if possible and the leads should be kept short. The leads should be shielded by placing under the ground mat if duct runs or tunnels are available, or placed in bonded conduit grounded at both ends.

Triaxial cable should be used for the utmost in shielding and one or more conductors of large cross section should be run along with the instrument leads. These large conductors should be grounded at both ends so as to form a short-circuited turn. Such shielding, if properly arranged, is quite effective.

For amplifiers, etc., an isolated ground bus should be used. This bus should be connected to ground only through instrument-lead shield

conductor. The chassis of the instrument should be connected to the recording location ground point.

Information to be recorded should be brought in at as high a potential or current level as feasible in order to keep signal-to-error ratio as high as possible. The authors attempt to bring all potentials in at a 100-v to 200-v level.

When using triaxial cable some experimenting may be in order to determine the best connections of the double shielding conductors. The authors have found that best results were obtained when both shield conductors are grounded at the source end. At the recording end the inner shield is connected to the instrument-isolated ground bus and the outer shield to the chassis, which is in turn connected to the instrument-location ground point.

**Differences in potential (ground gradients).**—Errors introduced in leads and equipment by such sources can be mitigated by connecting all conductors carrying ground-return current to a central low-impedance grounding point. Shunts, current transformers, voltage dividers, etc., should be located immediately adjacent to this point if possible. Recording equipment should be grounded at this point.

If the breaker under test is remote from this grounding point and ground faults are scheduled, the fault current should be brought back to this grounding point via insulated conductor. Breaker frame, etc., are grounded at this same point.

When the source ends of instrument leads derive data at locations that may differ in potential from that at the instrument location, low-resistance conductor should be run in close proximity. This conductor is grounded at both ends thus providing neutralizing transformer action to induce a longitudinal potential along the instrument leads approximately equal to the ground gradient.

**Proof of shielding effectiveness.**—If feasible, a final check for stray pickup should be made by conducting a preliminary test run, including operation of all recording equipment. All potential and current recording leads should be isolated from their sources of supply



## BREAKER PERFORMANCE *continued*

but with these supply ends terminated by an impedance approximately equal to that of their driving source. These terminals should not be isolated from any of their normal grounding connections. The object here is to obtain records under as nearly normal conditions as possible except for zero signal input. Any signals appearing on the records under such conditions will be from unwanted sources which may then be searched out and procedures adopted toward their elimination.

It is the authors' practice in the case of important tests to make two preliminary tests using fault currents of reduced magnitude. One of the tests is run to check for stray pickup, etc., as above, while the second is made with all equipment operating in the normal manner. This second test serves as an overall check of control equipment, timing, back-up operation, etc.

### Safeguards

**Equipment.**—The best protection is to make certain that unwanted voltages cannot be brought to recording equipment. Equipment failure may result in the introduction of such potentials in instrument and control circuits. Film cutouts, gaps or arresters may be employed to limit such voltages to safe values if instrument-insulation levels are coordinated with such protective devices. Selection of protective equipment should be made with care in order that its presence does not introduce errors in the recorded data.

**Personnel.**—Safety of personnel is utmost at all times. All test and observing personnel should remain at an adequate distance from equipment under tests as well as associated back-up devices. They should avoid all areas where large ground gradients may exist and out of contact with steelwork, yard fences, etc.

Suitable fire combatting equipment should be on hand as well as personnel familiar with its use. All safety precautions and clearance procedures must be clearly outlined and rigidly followed.

## Fault-Test Procedures

**Control of fault initiation and contact parting.**—Both control equipment and initiating device should be capable of such accuracy that the fault may be applied at any pre-selected point on the voltage wave. An accuracy of  $\pm 10$  electrical degrees will place the amount of current asymmetry under close control of the operator. This is essential if the number of tests is to be held to a minimum.

Inasmuch as maximum interrupting duty is a function of contact-parting point, this must also be under precise control of the operator.

**Conditions for maximum interrupting duty.**—To produce maximum interrupting duty on a breaker at a given location, certain criteria must be met, namely:

1. The current wave should be asymmetrical.
2. The power factor should be low; i.e. fault circuit predominantly inductive.
3. The final loop of current prior to interruption should be a major loop.
4. This major loop of current should have approximately 50% asymmetry.
5. Rate of rise and overshoot of recovery voltage should be as great as the fault circuit will permit.
6. Breaker contact parting should be adjusted for maximum arcing time. This means that any further advance in contact parting would result in interruption at the current zero preceding the desired major loop of current. (Our procedure is to adjust for major loop interruption and then advance contact-parting point in increments until a minor loop interruption is obtained.)

We believe the above conditions represent essentially maximum duty for all oil breakers. Although doubt might be expressed in some quarters as to whether asymmetrical faults are as severe as symmetrical for air-blast breakers, our experience indicates that the high current and only moderate reduction in recovery voltage rate associated with the 50% asymmetry point produces a very good test. For a more detailed discussion of this subject see discussions by E. C. Starr of references [2], [3], [4].

In the case of kilometric-type faults these criteria do not necessarily apply, except that maximum arcing time would still seem a necessity. In such cases the combination of fault current and rate-of-rise of recovery voltage selected will be contingent upon the dielectric recovery characteristics of the breaker. Some foreknowledge of this characteristic would seem to be in order if optimum conditions are to be generated.

**Preliminary timing adjustment.**—If the initiating switch and controls are accurate and consistent preliminary adjustment may be accomplished by causing the initiating switch to energize, at full voltage, a capacitance or other form of voltage divider. Oscillographic records of this voltage enable the operator to adjust for fault initiation at the desired point on the voltage wave.

Contact-parting time may be established by preliminary tests at low voltage. Selection of contact parting point for the initial test is more or less dependent upon the operator's experience. Here the object is usually to obtain as near maximum arcing time as possible on the initial test. In this way minimum number of additional tests will be necessary to establish performance at maximum duty.

Performance data on similar breakers are most helpful in achieving optimum initial parting point as is data on the system d-c decrement if proper final current loop asymmetry is to be realized.

If high-speed cameras are to be used their acceleration rates and running times must be known. This will permit the operator to establish their energization at a time such that the desired speed will be attained when the phenomena occur while having sufficient film in reserve to cover the desired span of time [5].

The same comments apply to oscillographs to the extent that they should be up to speed sufficiently in advance of the operation that constant speed will obtain throughout the important recording period.

### Line Dropping And Capacitor Switching Tests

**Control of contact parting.**—Breaker performance during interruption of capacitive current is directly related to contact spacing



or dielectric strength) at certain critical periods. This being the case, control of contact-parting point can result in a thorough investigation of behavior in a much fewer number of operations than if breaker tripping is random.

In general, if a breaker's performance is to be characterized by re-striking, this will be most likely to occur if the time interval between contact parting and current interruption is a minimum. In conducting tests the minimum contact spacing at which the breaker will interrupt and maintain interruption for at least  $\frac{1}{4}$  cycle should be determined. This region should then be thoroughly investigated for subsequent tendency toward re-striking. A smaller number of interruptions should also be made with contact partings occurring throughout the entire current wave. These are usually made at intervals of 15 electrical degrees.

**Bus impedance and recovery voltage.**—Experience has shown that, other factors remaining unchanged, leading current interruption will be the most difficult when the impedance of the supply bus is a minimum. By difficult, it is meant that the tendency toward re-striking will be the greatest. Low supply impedance means minimum regulation and therefore minimum initial recovery-voltage across breaker contacts. Initial interruption of current is thereby made easy and occurs at small contact spacings. If the breaker is to maintain this initial interruption and not re-strike it must acquire sufficient dielectric strength in the succeeding one-half cycle to withstand approximately twice the normal line or capacitor voltage. Restriking can be harmful not only to the breaker itself, but also to the system in which it is operating due to the production of transient overvoltage in certain areas and under certain conditions of circuit configuration.

Line-dropping and ungrounded-capacitor-bank switching tests should always be three-phase tests at maximum operating voltage. The voltage across the first pole to clear on a three-phase line-dropping operation continues to increase due to the capacitive coupling with the uninterrupted phases. This may result in a total voltage across this pole of 2.35 to 2.45 times normal

line-to-ground voltage instead of the approximately twice normal that would appear if the operation were single-phase. Single-phase tests, to be adequate, must be made at voltages that insure duplication of the three-phase recovery-voltage conditions. This may be difficult to do outside the laboratory and even there all variables may not be included.

No rule will be propounded as to proper line length for tests. The popular belief that long lines are the most difficult to switch may not always prove correct. Many breakers have been tested whose performance was poorest when switching short lines or sections of bus.

**Single and multiple capacitor bank switching tests.**—Here the type of tests to be performed will, to a large extent, be determined by the service for which the breaker is designed. If it is intended for duty involving the switching of shunt capacitors on a bus to which no other capacitors will be connected, then not much is to be gained by testing in the presence of parallel-connected banks. If, however, the breaker is intended for both types of service, it is essential that the tests include switching in the presence of parallel groups. In either case, low impedance of the supply bus is conducive to a more difficult test.

The authors are of the opinion that any breaker designed for capacitor-switching duty must be essentially re-strike-free in interrupting performance. By essentially re-strike-free is meant not over one re-strike per 100 three-phase interruptions. Furthermore, such occasional re-strikes must cause no damage to the breaker if and when they do occur. It is in this area that parallel-bank switching tests become of particular importance. A breaker may re-strike while switching single banks and sustain little if any damage even though the bus is of relatively low impedance. The presence of closely-coupled parallel capacitor banks can alter conditions to where a single re-strike may produce major damage to oil-circuit-breakers. In the authors' experience such damage has ranged from delamination of interrupter baffles to rupture of interrupter tubes, breaking of lift rods, cross-heads and even bushing fracture.

The presence of parallel banks modifies the initial rate-of-rise of recovery voltage to the extent of making it possible for the breaker to interrupt with very little contact separation, a factor which soon becomes a handicap in the race between system frequency recovery voltage and breaker dielectric strength between contacts.

Instrumentation for such tests on wye-connected, grounded-neutral banks is relatively simple although considerable difficulty has been experienced in accurately recording the high-frequency current transients that flow between closely-coupled parallel groups during the energization of one group; the others being previously connected. De-energization of the first group accompanied by re-striking of the breaker produces the same difficulties. The principal difficulty is in shielding of these current circuits from error potentials. It has been found essential to keep the incoming signal level as high as possible. This is accomplished by using relatively high-resistance shunts across which the C. R. O. input voltage is derived. This necessitates high quality current transformers capable of developing large secondary voltages without saturation. In addition, if such current transformers have multiple-turn primaries, these windings must be capable of withstanding high turn-to-turn voltages.

Voltage measurements during the switching of wye-connected ungrounded-neutral capacitor banks can be difficult, particularly when such groups are supplied from delta-connected transformers. The authors have obtained best results by using capacitance voltage-dividers and amplifiers for neutral-to-ground measurement while potential transformers usually are satisfactory for line-to-neutral information. The use of potential transformers between neutral and ground may result in ferroresonant oscillations.

#### Other Types Of Tests

**Out-of-step switching tests.**—Inasmuch as staged out-of-step switching tests on a large power system supplying critical customers would be extremely difficult to arrange and to justify, full-scale field tests



of breaker performance under these conditions have not been conducted. Tests have been performed to determine the conditions that must be met by a breaker during such interruptions. Such data may be obtained without the necessity of producing out-of-step operation. This is achieved by performing three-phase ungrounded fault interruptions while recording all the pertinent variables. If the fault location is chosen so as to be at the approximate center of impedance between the internal voltages of the two stations (or network equivalents), the recovery voltage across the breaker when clearing the three-phase fault will be approximately 50% of that which would appear on an out-of-step switching operation.

Such tests have been conducted on the system and subsequently verified by analog computer studies [6].

**Miscellaneous tests.**—Under this heading might be listed magnetizing-current switching tests and tests which, while primarily for other purposes, do involve power circuit breakers. The authors have had little occasion to conduct or otherwise participate in magnetizing-current interruption tests. This is chiefly due to the fact that breaker performance under such duty has never been a problem in our experience. Our system design requires that all transformers subject to no-load switching have an arrester on at least one winding thereby limiting any voltages that might be induced by breaker-current-chopping to tolerable values.

Careful consideration of data needed and equipment available may result in tests of the second type. For example, a series of lightning arrester tests was performed using a re-striking breaker to generate the desired overvoltages. This resulted in data on both the arrester performance and breaker deterioration.

### Interpretation Of Results

Analysis of breaker test data and the drawing of proper conclusions therefrom involve the summation of observations made during and after the tests and of analytical summaries of instrument records. Some of the salient points that should be observed in the perform-

ance of fault-interrupting tests are:

**During interruption.**—Excessive ground shock, expulsion of flame, gas or oil. Secondary explosions. Mechanical noise or other abnormalities. Excessive deflection of parts, etc. The high-speed camera is a valuable adjunct to such observations.

**After interruption.**—Integrity of all mechanical and electrical parts. This involves inspection of the mechanism, valves, etc., disassembly of interrupters and critical inspection of all essential parts thereof. Of particular importance is observation of contact erosion and the amount of material remaining before contact pressure would be lost.

Oscillograph records are analyzed to verify that maximum arcing times have been obtained. Proper contact make and break are verified as well as correct operating times. Interrupting times are measured and any abnormalities in arcing times are observed. In air-blast breakers arc duration is probably one of the most important criteria of performance. In oil breakers, arc duration and/or interrupter pressure can be the critical factors.

### Conclusions

1. The performance of full-scale field tests on power circuit breakers of new design can, if properly conducted, verify or void the rating assigned.

2. If such tests are to yield data accurately depicting breaker and system performance, particular care must be taken in instrumenting for records and specific procedures must be followed in conducting the operation.

3. Control of fault-current asymmetry and breaker-contact-parting point is considered essential during fault-interruption tests.

4. The performance of a breaker during interruption of capacitive currents is materially influenced by the voltage regulation (transient) of the supply bus.

5. Control of contact parting, when properly exercised, can result in a thorough investigation of capacitive-current interrupting performance, in a relatively small number of operations.

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*of recovery voltage associated with transmission line short circuits* (AIEE Trans., Vol. 76, pt. III, 1957, p. 1256-1264).

2. A. F. Darland, C. L. Killgore, C. J. Balentine and E. B. Rietz, *Field tests at Grand Coulee dam on 10,000-mva, 230-kv low-oil-content impulse circuit breaker* (AIEE Trans., Vol. 70, pt. II, 1951, p. 1371-1384. Discussion by E. C. Starr, 1384-1385).

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5. Everett J. Harrington and Harold C. Ramberg, *High-speed motion picture photography of electrical arcs on a high-voltage power system* (Journal of the Society of Motion Picture and Television Engineers, vol. 60, June 1953, p. 675-679).

6. W. M. Leeds and D. J. Povejsi, *Out-of-phase switching voltages and their effect on high-voltage circuit breaker performance* (AIEE Trans., vol. 71, 1952, p. 88-94).

7. W. M. Leeds and R. C. Vassie, *The interruption of charging current at high voltage* (AIEE Trans., vol. 66, 1947, p. 373-382).

8. Reinhold Rudenberg, *Transient performance of electric power systems* (book), McGraw-Hill Book Company, New York, N. Y., 1950.

9. W. M. Leeds, J. H. Pehrson and C. F. Cromer, *Oil circuit breakers for switching 115-kv shunt capacitors* (AIEE Trans., vol. 72, pt. II, 1953, p. 1066-1072).

10. P. C. Edwards and P. Q. Nelson, *Field testing of a 69-kv oil circuit breaker by the Southern California Edison company* (AIEE Trans., vol. 77, pt. III, 1958, p. 1682-1693).

11. O. Naef, J. D. M. Phelps, W. K. Wilson and A. L. Streater, *Field tests on a 345-kv high capacity oil circuit breaker at Philip Sparrow power plant* (AIEE Trans., Paper No. 59-188).

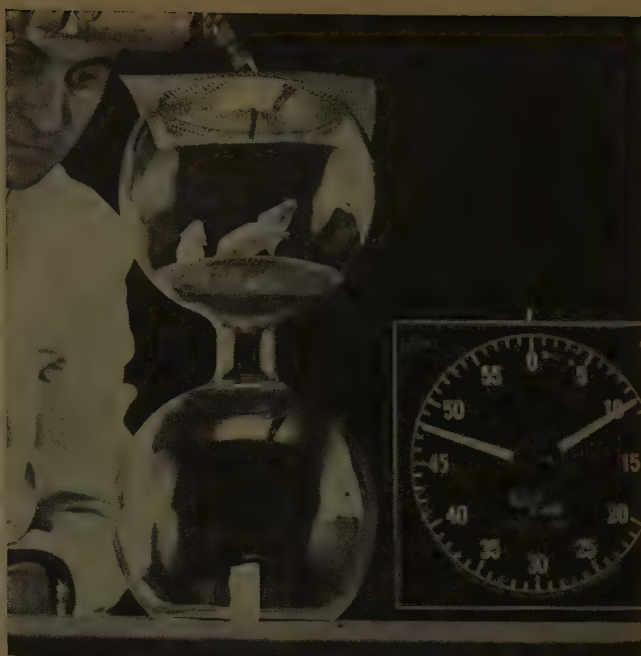


Operation of the interrupter is easily checked by attaching a jack and opening and closing the contacts by hand. This convenient operation-check is another cost-saving advantage over other breaker designs. The advanced interrupting techniques developed in this new gas breaker, improved contact design and efficiency of the  $\text{SF}_6$  (sulfur-hexafluoride) interrupting medium combine to *reduce the need* for periodic maintenance to a fraction of present accepted practice. *Over-all* maintenance costs of the Westinghouse gas breaker are estimated to be less than half those of other breakers.

Extensive field and laboratory experience (since 1953) has proved that  $\text{SF}_6$  is completely safe to use



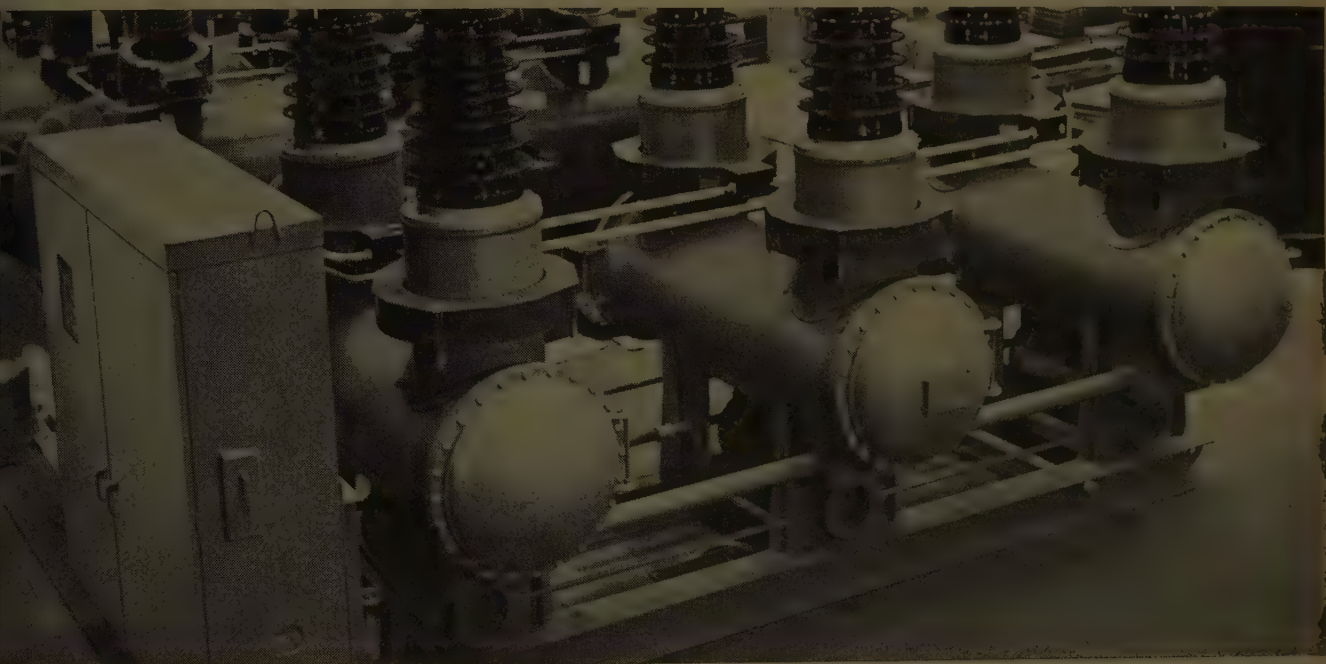
without any harmful effect on personnel. Only precautionary measures of the common-sense variety are recommended. The gas is carefully filtered by activated alumina, as it is circulated in the breaker high- and low-pressure systems, to remove any gaseous arc products. Any solid arc products left in the whole unit after evacuation can be quickly blown out



with compressed air.

This inert, nonflammable, nontoxic gas is heavier than air as demonstrated in the laboratory experiment above. The  $\text{SF}_6$  sinks to the bottom, snuffing out the candle. Tests show that the mice can live in a mixture of 80%  $\text{SF}_6$  and 20% oxygen for 24 hours without ill effect.

To learn more about the way the Westinghouse gas breaker can cut installation and maintenance costs and increase breaker performance, call your Westinghouse sales engineer. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. You can be sure . . . if it's Westinghouse. J-61006



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## Nation's Largest Capacitor Bank Passes Tests



One block of 360 GE capacitors, coupled with five other identical blocks, comprise the nation's largest EHV series capacitor bank. The 50-kvar capacitor blocks are part of the BPA 345-kv transmission system.

The nation's largest EVH capacitor bank, built for the Bonneville Power Administration, has successfully passed field acceptance tests.

Manufactured by General Electric, the installation is used to balance loading on BPA's 345-kv transmission system.

The bank is composed of 2160 50-kvar capacitors divided into six identical blocks—two blocks per phase. Each block is mounted on a special insulated platform and held in place in aluminum stack racks.

During the week-long testing, witnessed by representatives from several U.S. and Canadian utilities, extensive electrical checks on by-pass switching, protective gaps, overload relaying and automatic reinsertion were administered.

## Chance Adjusts Pricing Policy

The A. B. Chance Co. has announced that it has changed its delivery policy on hot line tools and grounding equipment so that the published prices of those products are now on a delivered basis, including freight to destination.

According to L. C. Hansen, vice president and general manager, the change was made for the convenience of customers. In order to cover the freight costs, prices on hot line tools and grounding equipment have been raised approximately 5 percent.

## Lighten Lamplighters Load



Trucks like this are helping modern lamplighters of Commonwealth Edison's Public Service Co. division make quicker, easier lamp replacements on street lighting systems maintained by the utility. One man can service up to 100 lamps a day with the help of the lamplighter truck.

## Points-Up Computer Speed

The impressive speed of the IBM 709 computer was recently brought out in a comment by James V. Ness, professor of electrical engineering and chairman of the computer center committee, Northwestern University. When solving a large problem on a 705, he found just after pushing the "start" button that he hadn't told the computer to print the answer. By the time he stopped the machine after a few seconds, he had already solved the problem—one which would have taken an hour on the IBM 650!

His comment accompanied news that Northwestern will install a 705 in its interdepartmental computer center in July. A large boost in demand for the computer by faculty and graduate students necessitated acquisition of the 709. The existing 650 is used about four times as much as three years ago. It was going more than 300 hours per month last summer, forcing the center's crew to work three shifts.



## b Crane, Hoist Cut MP&L Handling Costs



etter utilization of manpower is one economy realized by equipping service center with a jib crane and electric hoist.

The initial step in Mississippi Power & Light Co.'s efforts to harness increasing costs in handling poles and heavy equipment at its service center was the installation of a four-ton capacity jib crane and electric hoist, both manufactured by R. G. LeTourneau, Inc.

The results, proved out by carefully maintained records, led the company to include similar installations in future modernization and expansion plans. Consequently, since 1956, similar equipment has been installed at four other service centers.

Savings have been realized by the reduction in time of from one hour fifteen minutes to ten minutes to unload an average load of five poles; one man unloading of transformers, instead of the former full field crew; and the elimination of additional railroad sidings.

## Sharp Competition Forecast For Lighting Industry

The year 1961 will be a good business year for the lighting industry, but will probably not produce substantially larger industry sales than 1960, according to a statement by a Westinghouse lamp division executive.

Forecasting that tough competition can be expected on all fronts, F. M. Sloan, vice president and general manager of the division said that the sales will go to the company "who offers better quality, fewer products, more attractive packaging, and, in general, smarter merchandising and marketing techniques."

Speaking specifically, Mr. Sloan said that one bright spot in the picture is the continued rapid growth of the mercury-vapor lamp market. Ten years ago the industry sold \$4-million worth of mercury vapor lamps, in 1959 it was up to \$22-million, and for 1960 was about \$15-million.

## EDP Industry Headed For Period Of Greatest Growth

The electronic data processing industry in 1961 and the immediate years will experience its most rapid growth since the invention of electronic computers, according to Walter W. Finke, president of Minneapolis-Honeywell's Electronic Data Processing Division.

"The industry's growth, which may become almost explosive in nature as we move farther into the decade of the sixties, will be across the board—in business, industrial, scientific engineering, and military applications," Mr. Finke said. The biggest growth will in business and industrial data processing.

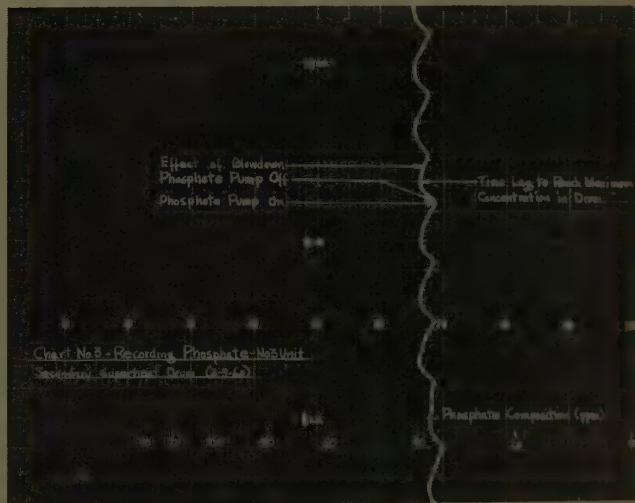
Mr. Finke stated that the EDP system and equipment manufacturing industry became a billion-dollar-a-year industry in 1960. He predicted that it would grow to between \$3-billion and \$5-billion by 1965.

## Automatic Boiler Contaminant Control System For Meramec Plant

Union Electric's newest steam generating station, Meramec plant, has installed a system for automatic on-stream control of boiler phosphate feed and determination of silica content of the boiler.

By detecting silica down to the fractional parts per million with unerring accuracy on a continuous basis, it is possible to prevent efficiency-robbing silica deposits forming on turbine blades.

In addition to phosphate and silica analysis, Union Electric is using the system, manufactured by Technicon Controls, Inc., to regulate blowdown and locate trouble spots in the system, such as condenser leakage. The AutoAnalyzer can also provide continuous records of trace quantities of copper, iron, phosphate, hardness, chloride, and other materials present in the steam-water cycle.



Actual Technicon AutoAnalyzer recording of phosphate in the No. 3 unit at Meramec plant of Union Electric Co. Use of the system eliminates the tedious task of making frequent repetitive tests by manual means often requiring as many as eight separate, time consuming steps.

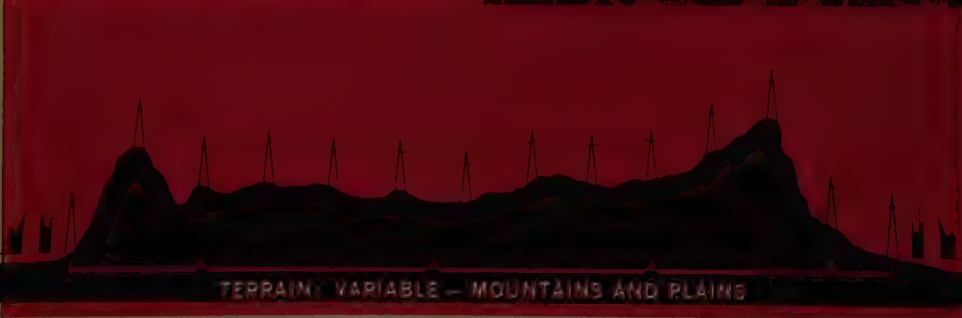


Transmitting increasingly large blocks of power over long distances without service interruption is the objective of the engineers who designed the

# PENELEC

thirteen-mile experimental line from Claysburg to Saxton, Pa. Almost all of the components — structures, conductors, insulators, hardware, etc. — were specially manufactured or adapted to accommodate extra-high voltages, as well as excessive mechanical stresses imposed by rugged terrain, high tensions, and extreme weather conditions. How each component will perform under extended EHV operation is yet to be determined. Collaborating with Pennsylvania Electric Company in this ambitious experiment is the Research & Engineering Center of Preformed Line Products Company, who have contributed for installation and comparative analysis a group of protective products designated as...

## Planned Line Protection for



The products in this advertisement are manufactured under one or more of the following: U. S. Patent No. 2,609,653; 2,691,865; 2,761,273; 2,722,393; and 2,959,632; other patents pending.



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- ① Clipping in a two-conductor bundle of 1.75" expanded ACSR with ARMOR-GRIP Suspension (AGS), the assembly that floats the conductor on a cushion of neoprene and eliminates line failures by distributing stresses over a wide area support. PREFORMED Rod End Corona Shields eliminate corona and radio influence at operating voltages.
- ② GUY-GRIP Dead-Ends are used at the top and anchor locations of 1/2" and 3/4" EHS guy strand which support a lightweight steel "H" frame structure. Dead-Ends at the top are specially designed with an extra large loop to accommodate 21" diameter tubular steel uprights.
- ③ Lineman, clipping in 1.75" bundled ACSR conductor at an angle structure, applies PREFORMED Armor Rods to protect conductors from damage which might result from extended vibration, chafing, arc-over, and concentrated clamping stresses. No tools are required to apply PREFORMED Armor Rods...an added benefit on bundled conductors.
- ④ Construction crew attending an orientation and practice session on application procedures of PREFORMED Spacers for bundled conductors prior to their installation on the test line. This unique spacer design prevents midspan hits or intertwining of conductors, and reduces Aeolian vibration.

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- ⑥ The maneuverable jeep-mounted PREFORMED LINE PATROL "scouts" data at remote structures, making simultaneous readings for later comparison with information accumulated by the DYNALAB. Thus, correlation of data received from various points along the line can be made, making the DYNALAB investigations more meaningful.

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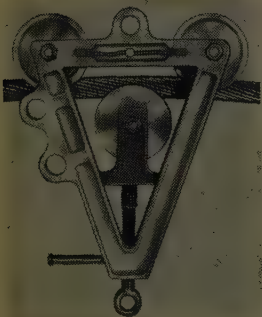
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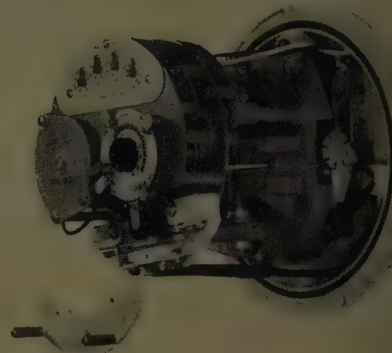
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## NEW PRODUCT DESIGN

### Now, Magnetic Flotation in Meter-Time-Switch Combinations

New meter-time-switch combinations with magnetic floating systems by **Sangamo Electric Co.** designated Types J3M and J3V, retain proven characteristics of superseded designs and add: a magnet flotation system, epoxy coated current coils, Glaskyd base with polyethylene gasket and a new spring clip cover ring.

The J3M features a standard kwhr register and a single or double pole, single throw time switch for automatic control of off-peak circuits. The J3V, designed principally for two-rate billing as well as off-peak circuit control, has a two-rate register which records kwh on two separate dials and is switched automatically. The entire load can be measured by the



two-rate register meter with time switch control of the register only to transfer the registration from the low-rate dial during off-peak hours to the normal-rate dial during on-peak hours.

Circle item #1 on reply card

### Vibration Counter

Jaquet vibration counter by **James Jaquet Ltd.** is specifically designed to register transmission line vibrations. It responds to all amplitudes above 0.03 in. in the frequency range from 5-50 cycles per second. Vibrations up to 100 cycles per second can be registered. This unit has been reviewed in AIEE Paper No. 59-96, dated February 20, 1959. This paper is available from Herman H. Sticht Co., Inc., United States distributor.

Circle item #2 on reply card



### Eliminates Pole Pikes

**Flex-Clip**, by **Welding Service Co.**, grabs a pole like a grocer moves cans from the top shelf. It eliminates need for pole pikes setting. As pole butt is centered over the hole, the top is guided in the clip. Pole is lowered and centered. Pole is then back-filled and tamped, after which it is plumb by moving digger boom. Grip the Flex-Clip makes it possible rake poles, too, by merely keeping tension on the winch line.

Circle item #3 on reply card



## Improved Compactor

Model improvements to "Rapak," self-propelled, one-man earth compactor by **Racine Hydraulics & Machinery, Inc.**, now make it possible to tamp narrow ditches as little as 4 in. in width and up to 40 in. in depth. It has a one-shot lubrication system built into the head of the machine as an integral part. Longer engine life is offered through a new sleeved, 4-cycle engine and a heavy duty centrifugal clutch. Gives 450 heavy ram blows per minute.

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Lever-type hot stick by **Bodenieck Tool Co.** is adaptable for compressing sleeves and connectors; also for cutting conductor. The same basic stick will take popular mechanical compressor jaws. Available complete with maximum hardness center cut Porter bolt cutter jaws specially adapted for cutting hard and soft conductors. Maximum rated cut is 4/0 ACSR. When desired as a compressor stick, unit is complete except for jaws.

Circle item #29 on reply card

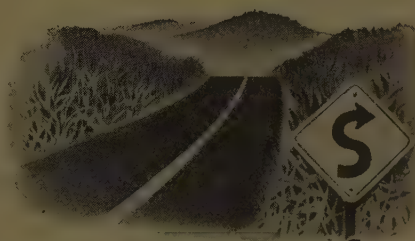
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**you're right:  
most photocontrols do look alike**

If most of today's street light controls all look like first cousins — outside, inside and sometimes even in their guarantees — how can you pick out the good ones? You could try putting them all in service, but it would be the most expensive test you ever ran. Another way is to look at *what* components are used, *how* they're used in the circuit, and what the *field experience*

of other utilities has been with the control.

Asking enough questions and getting realistic answers *before* you buy 10 or 20 thousand photocontrols pays off handsomely in street lights burning when they should — and in your getting to sleep at night. Fisher-Pierce Division, Sigma Instruments, Inc., 81 Pearl Street, South Braintree 85, Mass.



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Electrical and Electronic Equipment  
for Industry, Utilities and the Home



**Plastic Sleeves**

A plastic sleeve installed temporarily over an unfinished joint termination will keep dirt and moisture from the work overnight or for several days at a time necessary, according to the manufacturer, **G&W Electric Specialties Co.** Sleeve is slipped over cable before splicing begins. When work stops, it is pulled over the unfinished work, taped tightly at one end; desiccant and humidity indicator are inserted at the other end which is then taped. Waterproof paper is then installed over the whole thing.

Circle item #30 on reply card



**Hook Switch**

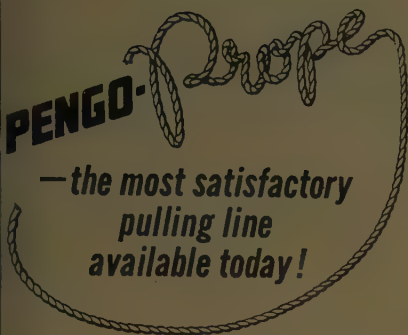
A new distribution hook switch designed for use with portable load break tools, is now available from **Memco Engineering and Mfg. Co. Inc.** The switch, rated from 7.5 kV to 23 kv, both 400 and 600 amps, suitable for single crossarm, double crossarm, or station structural mounting.

Circle item #31 on reply card





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(11.7 lbs. per 100 ft.,  $\frac{3}{4}$ " diam.)
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SPLICES LIKE MANILA**  
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excellent dielectric properties.

PENGRO-Prope is a synthetic rope of special construction for pulling line use. Although PENGRO has other synthetic and manila pulling lines, we believe PENGRO-Prope far surpasses these ropes in cost-saving performance.

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ENGINEERING CO., INC.  
Santa Clara, California  
Phone: AXminster 6-7712

## Plastic Tape Dispenser

Dutch Brand plastic electrical tape is now available in an improved dispenser, designed to cut plastic tape in a novel puncture-and slice-manner. This method, needing only one hand, ensures clean straight ends that make for neater work and tighter splices. In addition, tape is not stretched during cutting, thus eliminating loss of dielectric strength and adhesion, according to Johns-Manville Corp.

Circle item #32 on reply card



## Gauge Magnet

Long-life ceramic magnet by Lapp Insulator Co. is for use in the oil level gauge on the Lapp POC and POC-A line of ASA Standard Bushings 15-kv through 196-kv. Two permanent-type magnets in each gauge, one geared to the float in the oil reservoir, the other on the dial indicator outside of the reservoir housing activate the gauge through the solid wall of the reservoir, indicating oil level inside the bushing.

Circle item #33 on reply card



## Crapo

**GALVANIZED  
STEEL STRAND  
HAS ALL  
5**

1. Strength
2. Workability
3. Ruggedness
4. Long Life
5. Economy

When you select a size and grade of strand for a specific job you want to know that it meets every requirement of that job. You want ample strength to sustain the ultimate load—plus an adequate safety factor. You want pliability for ease of working in the field. You want ruggedness to withstand the abuse which may be encountered during and after installation. You want long, dependable life. And, you want reasonably low first cost and low maintenance costs.

For more than 50 years Crapo Galvanized Steel Strand has consistently demonstrated its ability to more than meet all of these requirements. Proof of its reliable performance is to be found in the case histories of overhead power and communication lines throughout the country.

Crapo Galvanized Steel Strand is fully protected against corrosion by heavy, uniform, dense coatings of commercially pure zinc tightly bonded to the individual wires. All grades and sizes are available in A, B and C weights of coating.



For details, ask our distributor or write direct!

**INDIANA**  
STEEL & WIRE  
COMPANY, INC.  
Muncie, Indiana



### Cable and Pipe Layer

Cable and pipe layer attachment which can lay telephone or power cable, plastic, copper or aluminum pipe and conduit without trenching is available from **American Tractor Eqpt. Corp.** A special cable-laying shank mounted on the tool beam of the heavy-duty ATECO ripper opens up a cut and buries the cable or pipe in one continuous operation. Shanks for burial depths to 72 in. are available. Cable or pipe is carried on suitable reels.

*Circle item #34 on reply card*

### Safety Shield

Safety shield by **Special Products Div., Singer Glove Mfg. Co.** can be used on the job or in the shop. Offers full protection in welding, grinding and cutting operations or can be used as a dividing partition. It can be assembled or taken apart in three minutes without tools. No hooks, screws, bolt or wires—curtain wraps around frame with snap fasteners. Fire-resistant curtain is heavy duck.

*Circle item #35 on reply card*



### Constant Load Winch

Hydraulic winch by **Brade Winch Div. of Motor Product Corp.**, combines constant load, constant speed, constant horsepower with safe, efficient one-man operation. In the Model CL, two power drums do the pulling while a large capacity storage drum takes up the cable. Complete safety is achieved with an automatic worm brake that is self-adjusting to wear and load. The load on the cable applies the brake pressure. Brake locks on power failure.

*Circle item #36 on reply card*

A  
NEW  
LINE  
OF  
FULLY  
AUTOMATIC  
SILICON

### BATTERY CHARGERS

- ◆ NEWEST CIRCUITRY OF PROVEN DESIGN
- ◆ COMPLETELY STATIC MAGNETIC AMPLIFIER CIRCUITRY
- ◆  $\pm 1\%$  VOLTAGE REGULATION WITH  $\pm 10\%$  LINE VARIATION
- ◆ REMOVABLE CABINET SHELL
- ◆ COMPLETE ACCESSIBILITY TO ALL CONTROLS
- ◆ STANDARD UNITS NORMALLY IN STOCK

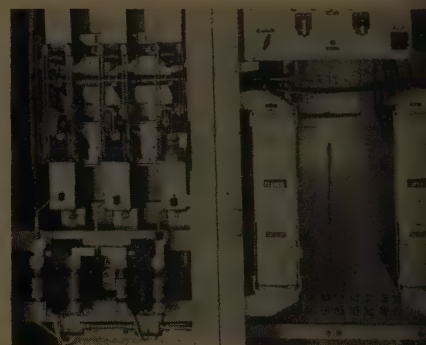
Standard Units  
1, 3, 6, 12 and 25 amperes;  
24, 48 and 129 volts

Ask for Bulletin BC-323. Inquiries invited on units up to 300 amperes



Custom Equipment Division  
**ACME ELECTRIC CORP.**

CUBA, NEW YORK  
PLANTS IN CUBA, N. Y.  
ALLEGANY, N. Y.



### Switchgear Operators

Electric operators by **S&C Electric Co.** for its high-voltage metal clad fuse load interrupter switchgear uses a motor-operated worm driven gearhead powered by control circuits of 12, 48, 125, or 250 v-d-c, or 120 or 240 v-a-c. Used for 4.8- to 14.4-kv switching centers, substation primaries, substation secondaries, and service entrances. Can be manually operated. Interlock switch prevents motor operation when the hand crank is engaged.

*Circle item #37 on reply card*



## Bushing Section Formed By G-E

Formation of a bushing product section has been announced by General Electric. The new section began operation last month as a separate business, completely divorced from its former position as an integral part of the company's power transformer department.

The new product section will function under G-E's decentralization principles, with its own marketing, manufacturing, engineering and finance groups, while remaining under the authority of power transformer department general manager G. A. Hoyt. N. Eugene Willow has been named general manager of the section.

Products manufactured by the section will include apparatus and cast glass bushings, potential devices, bushing current transformers, and instrument transformers above 69 kv.

## I-T-E Reorganizes Marketing Areas

Establishment of seven new geographical marketing areas instead of four larger sales regions has been announced by I-T-E Circuit Breaker Co. The move was designed to improve customer service and enable I-T-E to better serve its markets more effectively.

## A-C Installs First Low-Profile Turbine-Generator



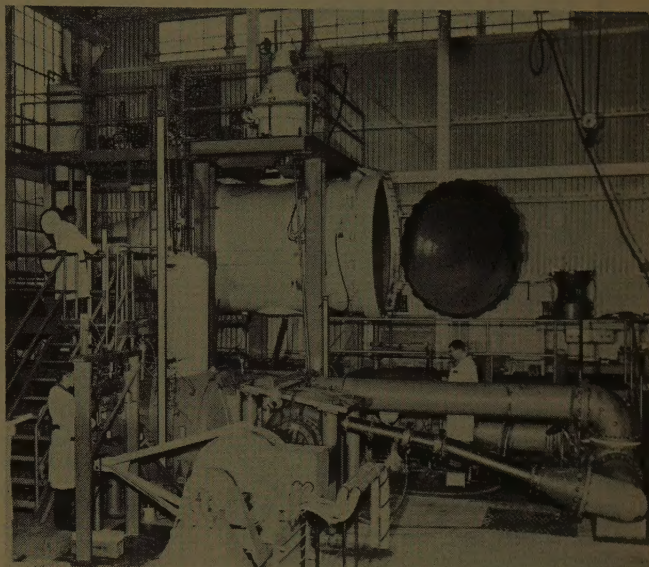
men responsible for building and installing this first centerline-at-floor-level steam turbine generator unit for Wisconsin Electric Power's Oak Creek station gather around their handiwork. A similar 275,000 kw unit—No. 6—is currently being installed and will go into operation later this year.



## SUPPLY FACILITIES

### Expand Hydraulic Laboratory Facilities

Short notice demonstrations of the actual performance of any proposed turbine, pump, or pump-turbine unit are now possible at Allis-Chalmers expanded hydraulic laboratory at their York (Pa.) Works. Equipped with eight test stands, three of which are adaptable for pump-turbine testing at 50-, 100-, and 300-ft capacities, the modern laboratory permits a wide range of tests, several of them simultaneously.



### Integrate Federal Pacific Manufacturing Operations

Sixteen of Federal Pacific Electric Co.'s manufacturing operations have been combined into three regional manufacturing groups, it was recently announced by T. M. Cole, president.

"Since becoming a \$100-million company, we find there is considerable advantage in administering our widely scattered plants through area groupings headed by experienced management teams. Our objective is to provide local freedom of action to the maximum extent practical," Mr. Cole stated.

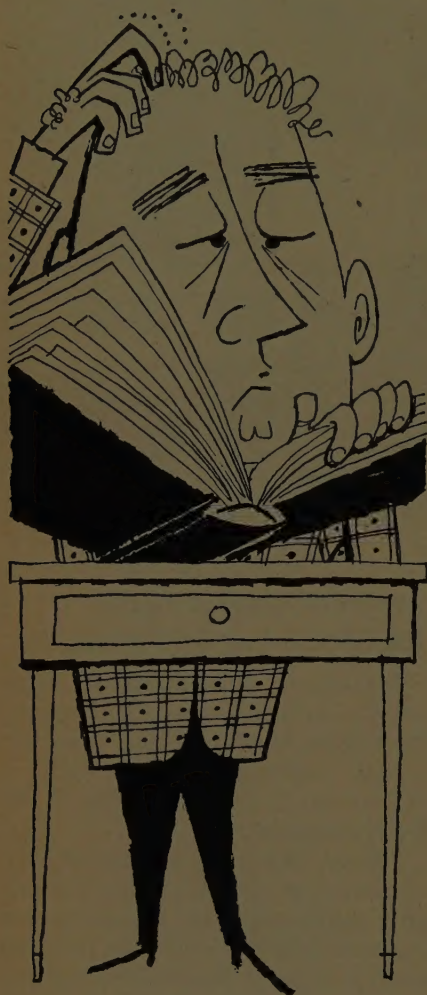
The eastern manufacturing group, headed up by John T. Romano, v.p., will include the company's three Newark, N. J., plants as well as plants in Atlanta, Ga., Boston, Mass., Pittsburgh, Long Island City, and South Plainfield, N. J.

The Central group will be headed by Clifford E. Harris and will include plants in St. Louis, Dallas, Cleveland, and DesPlaines, Ill.

The western group, under Leonard P. Shelley, v.p., will have plants in Santa Clara, Los Angeles, and San Francisco, Calif., as well as Seattle, Wash.



# Searching for Enclosures?



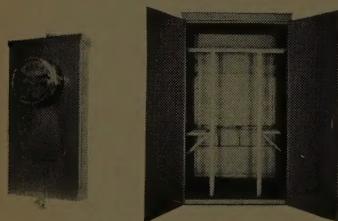
look to ...

**SUPERIOR**  
SWITCHBOARD & DEVICES CO.

CANTON, OHIO

A Subsidiary of

The Union Metal Manufacturing Co.



Convert-A-Socket

Meter Booth

Write for a free Catalog outlining types and sizes of enclosures, reactors, test switches, test blocks, and meter socket equipment.

## 25 Years Ago ... in Electric Light and Power February, 1936

Summing up 1935 for electric utility executives, EEI President Thomas N. McCarter said that utilities paced the recovery in 1935, with August output back to pre-depression levels. By December, it exceeded the 1929 figures by nearly 8 percent. The entire production of electricity in 1935 for all purposes is estimated at 99-billion kwh. The number of consumers showed an increase of 550,000 to about 25,350,000. In 1935 the average price of electricity for a household stood at 5.04 cents per kwh, as compared to 5.30 cents per kwh for the previous year. Taxes continued their upward march and approximated \$260,000,000 or 14 percent of revenue.

A permanent Rural Electrification Administration with broad powers to finance the electrification

of areas not receiving central station service is proposed in a bill introduced by Senator Norris and in the House by Representative Rayburn. An appropriation of \$10 million for the next fiscal year and a like sum for each of nine years thereafter would be authorized.

The New York Edison Co. announced that it will install two new high pressure boilers and one new 50,000-kw 60 cycle turbo-generator at its Waterside station. Thirty-six of the 146 existing boilers in the station and three of the present generators will be retired. The boilers will operate at 1500 psi and 900F.

After refusing to sign a TVA contract, Union City, Tenn., is now offering to furnish electricity from its municipal plant at two cents per kwh to farmers in the surrounding territory, providing they build and maintain the distribution lines within the city limits.

The expected decision by the Supreme Court on the constitutionality of TVA, has not been handed down yet and the earliest date on which a decision is expected is February 3.

The TVA board of directors has directed that immediate construction begin on the Chicamauga dam which will be built on the Tennessee river, seven miles above Chattanooga.

Bath, Maine, became the second "all-electric" town in the U. S. with replacement of gas service by electricity for cooking by Central Maine Power Co. Damage to gas mains made it uneconomical to repair the mains for gas service. The company agreed to replace all gas equipment with electric appliances of the same size at no cost to the consumer.

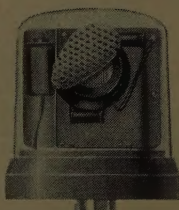
New York City was darkened January 15 in an area north of 59th Street due to a fire in the Hell Gate generating station. The outage occurred just before the peak load time in the late afternoon, and was attributed to a short in one of the bus bar sections of the electric galleries. Service was restored in most areas by the next morning.

## The Facts of Life in Street Light Control

1. Big killer of photo controls is transient voltage surges in secondaries which are below the spark-over of lightning arresters.

2. LUMATROL MARK I uses Varistors in conjunction with a secondary lightning arrester to withstand ALL transients up through the capabilities of the secondary arrester.

**AUTOMATIC... COMPACT...  
LIGHTWEIGHT...  
SIMPLE...  
...AND  
COMPLETELY  
RELIABLE!**



WRITE FOR BULLETIN 91a.

**MICRO BALANCING, INC.  
GARDEN CITY PARK, N.Y.**

In Canada: J. R. KEARNEY CORP.  
Box 270, Guelph, Ont.



## Sangamo Elects Wylie; Re-elevate Three Others



Wylie

Robert R. Wylie, formerly manager of electronic product sales, has been elected a vice president of Sangamo Electric Co. At the same time, the board of directors voted to ele-

ate R. C. Lanphier, Jr., C. L. Clark, and D. C. Blanchard to newly-created senior vice president positions.

Mr. Wylie, whose new title is vice president—manager of electronic product sales, has been active in the utility industry for over 20 years. He joined Sangamo in 1957 as marketing manager, after serving as manager of meter and capacitor sales for the Rumsey Electric Co. in Philadelphia since 1941. Mr. Lanphier has been a vice president since 1939 and was named director of sales in 1957. Mr. Clark has been vice president and treasurer since 1953, and Mr. Blanchard vice president in charge of manufacturing since 1954. All are members of the board of directors and continue their present responsibilities.

## Zinder Names VP

Frank P. Saponaro has been named a vice president of H. Zinder & Associates, Inc., consultants and engineers specializing in the power and energy industries.

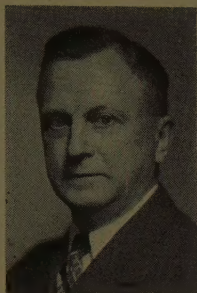


Saponaro

Prior to joining the Zinder organization in 1958, Mr. Saponaro was vice president of a gas transmission company. From 1942 to 1950 he was with the FPC and served as head of the agency's rate filings and contract analysis section. Prior to that he was head of the rate section of the Rural Electrification Administration.

## MEN OF POWER

### Edison Medal To Osborne



Osborne

The prized Edison Medal of the American Institute of Electrical Engineers has been awarded to Dr. Harold S. Osborne, retired chief engineer of the American Telephone and Telegraph Co.

The award was presented at the Winter General Meeting of AIEE held in New York early this month.

Dr. Osborne, who is a consultant with the International Electrotechnical Committee, was cited "for his contributions to the art of telecommunication and his leadership and vision in extending its application; for his achievements in the coordination of international communication and in national and international standardization; and for his advancement of the engineering profession."

### La. Society Award To Nairne

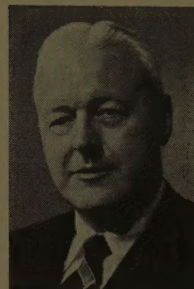
Clayton L. Nairne, executive vice president of New Orleans Public Service Inc., has been designated as recipient of the Louisiana Engineering Society's 1960 Civic Affairs Activities—Andrew M. Lockett Medal.

The award is given annually to the Louisiana engineer who displays the highest degree of interest and ability in altruistic community affairs. It is one of two awards made by the society for 1960.

### New Duties For Haswell

Andrew J. Haswell, vice president of Oklahoma Gas and Electric Co., has assumed executive responsibility for the company's Oklahoma City and western division operations. He will also have responsibility for personnel administration.

### GE Names Dunn



Dunn

General Electric Co. has announced the election of Oscar L. Dunn as vice president. The announcement was made by Ralph J. Cordiner, chairman of the board.

Mr. Dunn is general manager of the company's Motor and Generator division.

A governor of NEMA, Mr. Dunn joined GE immediately following his graduation from Indiana University in 1936. In 1945, he was named assistant to the vice president in charge of Affiliated Manufacturing Companies department.

From 1947 to 1951, he was with GE subsidiaries in the medical field. He became administrative assistant to the executive vice president of GE's Apparatus group in 1951 and was promoted to general manager of the Direct Current Motor and Generator department in mid-1953, a position he held until becoming general manager of the Motor and Generator division in July, 1958.

### CHG&E Elects Two

Ernest R. Acker, president of Central Hudson Gas & Electric Corp. and former EEI President, has been elected chairman of the board of the utility. He is succeeded by L. F. Sillin, Jr., vice president.

A director of EEI, Mr. Acker joined the utility in 1919, starting in the engineering department. After several promotions, he was named commercial manager in July of 1925 and was made a director of the company a year later.

Mr. Acker was elected president of the utility in 1932.

Mr. Sillin joined CHG&E in 1951 as secretary and assistant treasurer. He was named assistant general manager in 1953 and a vice president and director in 1955.





## CALENDAR OF EVENTS

February 13-16—American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Annual Meeting and 15th International Heating and Air-Conditioning Exposition, International Amphitheatre, Chicago, Ill.

February 16-17—American Public Power Association, Engineering and Operations Workshop, Colorado Springs, Colo.

February 16-17—Pennsylvania Electric Association, Engineering Section, Electrical Equipment Exposition, Pick-Roosevelt Hotel, Pittsburgh, Pa.

February 16-17—Southeastern Electric Exchange, Accident Prevention Committee, Buena Vista Hotel, Biloxi, Miss.

February 23-25—National Wiring Bureau, 17th Annual National Wiring Sales Conference, Sherman Hotel, Chicago, Ill.

March 5-8—Third Annual Lighting Exposition, World Lighting Forum, New York Coliseum, New York, N. Y.

March 5-9—American Society of Mechanical Engineers, Sixth Annual Gas Turbine Conference, Shoreham Hotel, Washington, D. C.

March 6-8—American Management Association, Seventh Annual Data Processing Conference and Exhibit, Statler-Hilton Hotel, New York, N. Y.

March 9-10—AIEE, IAS, IRE, Second Symposium on Engineering Aspects of Magnetohydrodynamics, University of Pennsylvania, Philadelphia, Pa.

March 20-22—Edison Electric Institute, Sales Conference, Edgewater Beach Hotel, Chicago, Ill.

March 21-23—American Power Conference, Sherman Hotel, Chicago, Ill.

March 27-29—Southeastern Electric Exchange, Annual Conference, Boca Raton Hotel and Club, Boca Raton, Fla.

April 5-6—North Carolina State College, The South Atlantic Wood Utility Pole Conference, State College Campus, Raleigh, N. C.

April 6-7—American Society of Mechanical Engineers, Management Engineering Conference, Statler-Hilton Hotel, New York, N. Y.

April 6-7—Pacific Coast Electrical Association, Engineering and Operations Section, Ambassador Hotel, Los Angeles, Calif.

April 17-19—A & M College of Texas, Fourteenth Annual Conference for Protective Relay Engineers, College Station, Tex.

April 17-18—Pacific Coast Electrical Association, Business Development Section, Sheraton-Palace Hotel, San Francisco, Calif.

April 26-27—Indiana Utility Association, Twenty-first Annual Young Men's Utility Conference, Severin Hotel, Indianapolis, Ind.

April 27-28—Pacific Coast Electrical Association, Administrative Services Section, Villa Hotel, San Francisco, Calif.



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